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Full-Spectrum Engineers

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U.S. Army Engineer School

573-xxx-xxxx / DSN 676-xxxx

COMMANDANT
MG Anders B. Aadland
563-6158
aadlanda@wood.army.mil

ASSISTANT COMMANDANT
BG Randal R. Castro
563-6192
castror@wood.army.mil

REGIMENTAL COMMAND SERGEANT MAJOR
CSM Robert R. Robinson
563-8060
robinsonr@wood.army.mil

DEPUTY ASSISTANT COMMANDANT
COL John (Pat) Leake
563-8080
leakej@wood.army.mil

DEPUTY ASSISTANT COMMANDANT – USAR
COL Jimmy T. Fox
563-8045
foxj@wood.army.mil

DEPUTY ASSISTANT COMMANDANT – ARNG
LTC Robert Hudnall
563-8046
hudnallr@wood.army.mil

TRADOC SYSTEMS MANAGER for ENGINEER COMBAT SYSTEMS
COL John Holler
563-4081
hollerj@wood.army.mil

TRADOC PROGRAM INTEGRATION OFFICE - TERRAIN DATA
COL David Kingston
563-4086
kingstond@wood.army.mil

COMMANDER, 1st ENGINEER BRIGADE
COL James Rowan
596-0224
rowanj@wood.army.mil

DIRECTOR OF TRAINING
COL Jeffrey LaMoe
563-4093
lamoej@wood.army.mil

DEPARTMENT OF INSTRUCTION
LTC Jeffrey A. Bedey
563-4129
bedeyj@wood.army.mil

CHIEF OF DOCTRINE
LTC William Duddleston
563-7537
duddlestonw@wood.army.mil

COUNTERMINE TRAINING SUPPORT CENTER
Mr. Paul Arcangeli
596-3869
arcangelip@wood.army.mil

DIRECTOR OF ENVIRONMENTAL INTEGRATION
COL Robert S. Kirsch
563-4119
kirschr@wood.army.mil

By Order of the Secretary of the Army:
ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:
Joel B. Hudson
JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0123002

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ENGINEER

The Professional Bulletin of Army Engineers

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UNITED STATES ARMY ENGINEER SCHOOL

COMMANDANT
Major General Anders B. Aadland

MANAGING EDITOR
Lynne Sparks

EDITOR
Shirley Bridges

GRAPHIC DESIGNER
Jennifer Morgan

Front Cover:
Full-spectrum engineers - at home and abroad.

Back Cover:
U.S. Army engineers in action.

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Clear The Way

By Major General Anders B. Aadland
Commandant, U.S. Army Engineer School

The second year of the third Millennium finds our nation and its allies prosecuting a new and different war, one that takes asymmetry to the extreme: the war against terrorism. For the first time in more than a century, our citizens are genuinely concerned about our security here at home. Over the last 100 years, peace and security in the western hemisphere have allowed our democracy to thrive and grow, while our military focused on and designed itself to fight conventional battles in distant theaters. That situation changed very suddenly on 11 September 2001. The comforting adage, "Sleep well, your Army is awake," took a shot that none of us saw coming.

In the 2001 Quadrennial Defense Review, the Secretary of Defense established the mission of defending the U.S. homeland as the top priority for the Department of Defense. U.S. military commanders have now been given additional authorities to defend the states, territories, trusts, and commonwealths of America and have set about developing plans and training to increase the military's ability to respond more effectively and quickly to requests from civil authorities to combat terrorism in our country.

Our government is working feverishly to develop operational concepts and technologies to detect and deter terrorist threats before they happen. In the unfortunate event an attack on our homeland is successful, local, state, and federal agencies are expected by the American public to have a system in place that will trigger a seamless system of rapid response and recovery. The Army and its maneuver support branches—Engineer, Military Police, and Chemical, in particular—will always be among the first DoD assets called upon to support the emerging 21st century national and military security strategy.

The 11 September attacks were threshold events with profound implications for our military, leaving absolutely no doubt that terrorism is a pervasive threat to the nation's security. The Army's response through Operations Noble Eagle at home and Enduring Freedom abroad have already imposed significant impacts upon the Engineer Regiment. Unprecedented Homeland Security (HLS) and antiterrorism requirements will change the face of the Army and Engineer Corps forever. With the Army's aggressive pursuit of the Objective Force, we already understand that the tactical side of the Engineer Corps will undergo profound change over the next decade; but the events of 11 September have brought to the fore changes that must be made immediately. Combat Engineer doctrine, units, systems, training, tactics, techniques, and procedures (TTP) must address a new threat, a new operational environment here and abroad, and new roles that must fill voids in Army planning. In the HLS arena, Engineers have always been key players in areas such as fire fighting, prime power, civil and environmental engineering, disaster relief, barrier design and construction. But now, the Engineers also join the combined arms team on the tactical front to chart out the warfighting TTP on a potential battlefield we call home.

Overseas, we face new asymmetric threats that challenge the conventional TTP of the combat Engineers. For example, our intense examination of the mine and booby trap threat in places like Afghanistan and the Middle East have produced a wake-up call to our countermine doctrine, training, and operational TTP. We will be reporting to you in detail on how countermine DTLOMS have already turned a sharp corner from the conventional battlefields of the Soviet-influenced past and how the Engineer School must deal with this as an urgent priority.

The Army leadership is asking the Engineer Corps to be prepared under its HLS role to successfully perform "homeland defense and civil support" missions as two simultaneous and mutually supporting functions. Homeland defense requirements could assign Army Engineer forces augmentation and assistance tasks to restore critical infrastructure capabilities or to respond to, if required, simultaneous and possibly different weapons of mass destruction incidents. Civil support requirements could place Army Engineer resources and forces in support of lead local, state, and federal authorities responding to natural and man-made disasters and other critical national events such as civil disturbances or special security events. Engineer civil support requirements would be part of a progressive effort starting with local and state first responders initially supported by state-controlled National Guard units supplemented with federal assets including unique Army Engineer capabilities on an exception basis.

In developing an Engineer Corps HLS strategy, the first step is determining the Army and Engineer Corps's HLS roles and finding the gaps between where the Engineer Corps is today and where it needs to be tomorrow to support the full-spectrum Army HLS mission requirements. The second step is defining the future Engineer capability requirements in measurable terms of performance and knowing what tasks need to get done as an integral member of a new Army HLS combined arms team. The third step is building a bridge across any Engineer role gaps and tailoring our comprehensive skill base to new missions and TTP that address the new operational environment. We must focus all the strategic instruments of Engineer planning at our disposal to fill any voids and enhance the strengths in our Engineer capabilities. We know this will require many changes on the Engineer front. Successfully developing this HLS strategic capability will call upon the proven innovation, discipline, patience, and resolve of every Engineer soldier and leader.

We are fortunate to have much upon which to draw to chart the way as a key member of the nation's HLS force. Army Engineers

(Continued on page 16)

Lead The Way

By Command Sergeant Major Robert R. Robinson
U.S. Army Engineer School

While preparing to write this article, I couldn't help but ask: Where did the last year go? Although the events of the year have run together for me, the events of one day—11 September—remain as clear as they did on that day. Those events have had a profound effect on our Army, our Regiment, and our way of life; they have dramatically changed the way we, as Americans, live. The last year has been extremely eventful for us all, marked by all those things (especially 11 September) that effect change in our Army and Regiment and affect our most valuable resource—our soldiers. I will focus this article on transition, safety, and change.

Transition can mean so many things, especially to soldiers. We transitioned to the beret, despite all the controversy. Although not fully fielded throughout our Army, I think it was accepted by the majority of our force. Transition can mean the physical move of units from home station, on deployments, which takes soldiers far away from family and the security of familiar surroundings, and now more so, in light of 11 September. To others, it means transitioning in and out of organizations. Every month, one-twelfth of our enlisted force moves on permanent change of station to new organizations. We need to ensure that sponsorship and integration happen and that all these soldiers are welcomed into our units properly. Much of our Regiment's leadership has transitioned over the past months, and those new command team relationships are now solidly leading their organizations. Although we embrace these transitions in leadership as necessary and common in our Army, it has a distinct effect on soldiers, civilians, and their families.

Safety awareness, force protection, and risk management procedures are and will continue to be of paramount importance as our Regiment and Army transition towards the Objective Force. The events of and since 11 September have demanded that we discontinue our complacent attitude towards the safety and security of not only our soldiers but also of our citizens. Since the stand up of the Initial Brigade Combat Teams (IBCTs) at Fort Lewis, Washington, and the recent announcement of four more brigades to become IBCTs, we have begun to change the way we prepare for and execute training. In doing that, we must be aware of the impacts of those changes on our risk assessment and force protection procedures.

Last year we lost too many soldiers in our Regiment and Army, and with the increased emphasis on homeland security and deployments, the potential for our soldiers to be placed in harm's way has grown tenfold. The loss of a soldier's life has a profound effect on the unit and family. Remember how stunned we all were when the attacks on the World Trade Center and Pentagon and the plane crash in Pennsylvania happened, and the reality of the great loss of life that resulted. Our country went into a momentary stall but recovered quickly; yet families, organizations, and services were significantly impacted. We can take actions within our units and organizations to minimize the potential for risk, even in light of our given situation. Soldiers who stand watch and provide force protection to our installations need to be reminded not to become complacent. Leaders must continually reinforce to soldiers the importance of what they do and remind them of the state of readiness and awareness of our country. Routine and normal are no longer SOP in our daily duties. Many of us have been involved in the upgraded security measures on our installations and, as we become more accustomed to our increased force protection, we must always remind ourselves and our soldiers of what brought us to implement the measures we have.

With transition and renewed focus on the direction in which our Army and Regiment are going come change. One of the issues I said I would focus on and work to improve was the Sapper Leader Course. Through the efforts of many of the commanders and command sergeants major of the Regiment, along with the leadership of the 577th Engineer Battalion and the Sapper Leader Course, we have made some significant changes which will produce a better sapper. In a nutshell, we have revised the course in an attempt to reduce the attrition related to the Army Physical Fitness Test (APFT) and land navigation events. Additionally, we have moved the 12-mile footmarch to the 5th day of training and are changing the hand-to-hand training and patrolling phase of the course. We are also rewriting the prerequisites for the course so that **ALL** engineer soldiers are eligible to attend. All these revisions should result in more soldiers graduating from this outstanding leader development course. We ask that the commanders, command sergeants major, and first sergeants of the Regiment put their emphasis on ensuring that units fill their assigned quotas with fully prepared (mentally and physically trained) soldiers.

Many other changes are brewing in our Army: the proposed APRT program, the revision of AR 670-1, and the updated NCOER, to name a few. Many throughout all components are discussing the merits of change and the many challenges that these changes present. It is our duty to advise those making these policy decisions, based on our experiences and knowledge, but I would just ask and expect that the leaders of our Regiment be professional when doing so. And when the decision is made, I fully expect and know that we all will salute and move out and support the decisions made.

I would again like to thank all the leaders and soldiers of our Regiment for all that you do for our Army. As I traveled around the Army and visited units over this past year, I have gained a better appreciation of what you all do to represent the Engineer Regiment in the many missions of our Army. I am truly proud to be an engineer and to be in the company of such great servants to our nation.

Engineers Lead the Way!

A Call to Rescue: Sappers Assist at the World Trade Center

By Sergeant First Class William Rostad

It is 0130 hours on 17 September 2001. I am standing on top of a pile of twisted metal and cement dust that rises 100 feet in the air on what used to be a street in New York City. This rubble is all that remains of the two World Trade Center Towers. When I am not moving, I notice that the soles of my boots are melting from the heat inside the pile of debris. At least 5,000 firefighters and police have passed out from exhaustion at the edges of this mess, most of them still covered with the fine gray dust that resulted when the buildings fell 6 days ago.

My guide takes me to where the rescue teams are trying to move large oxygen and acetylene bottles over wreckage that a mountain goat would not cross. There is steel everywhere—laying down, sticking up in the air—it is indescribable. The news reporters were right—pictures on TV cannot come close to depicting the magnitude of the destruction. The steel sticking up150 to 200 feet in the air looms like a big flyswatter. Each 15- by 20-foot piece weighs from 7 to 20 tons, depending on the part of the building it came from. The smell in the air is like the one you experience when you are engulfed in the dust cloud that results after a door or wall charge detonates. The respirator cannot mask the smell—it just causes a rubbery taste in your mouth. I have never felt so small or insignificant or been humbled so much by my surroundings in my life.

Why was I there at "Ground Zero?" My mission statement was simple: help the rescue workers move the mound of rubble—easier, safer, and faster. I was to train, maintain, assist, and advise the rescue workers on the use of the Broco® torch, a manpackable torch system created to meet the military's tactical cutting needs, such as during operations in an urban environment. Weighing half as much as industrial cutting sets, the torch can cut almost 10 linear feet of 1-inch-thick steel in less than 10 minutes. The torch's small tanks allow the user to maneuver in smaller places.

In addition, I was to provide training to the rescue workers on the handheld thermal camera and the infrared pole camera. Thermal cameras make it possible to find underground fires in the rubble before rescue workers unknowingly lift heavy pieces, giving the flames oxygen and causing the fires to spread.

Aerial view of Ground Zero

Therefore, the few fire trucks that were still working in the area could be deployed elsewhere. We hoped that we would find signs of body heat with the thermal cameras and effect a rescue—even though no one had been found alive after the first day. Because the cameras allowed us to search areas and determine sooner if there was life there, heavy machinery could move in sooner to clear the debris.

The infrared pole cameras saved hours of search time by allowing us to search huge, dark chasms through small holes, rather than having to create a hole large enough for someone to crawl through to search.

At the disaster site, I was under the operational control of the Department of Defense Federal Emergency Management Agency team from Fort Drum, New York. Even though I was there to train others, I knew that before I left, I, too, would learn a lot.

At 0730, I started training the first group—the New York Police Department Emergency Services Unit. The initial training lasted 10 minutes, and I prepped each torch system and conducted the before-use checks for them. Most of these guys had not slept for 2 to 3 days; showing them anything more than how to turn the torch on, start it, burn through the steel, and shut the torch off would have been a waste. I told them to call me or bring the system to me if they had any problems.

Training on the cameras took about 3 minutes, and then away the workers went for a 12-hour shift. On the first day, we couldn't find holes to insert the pole cameras into. There were people from the Hilti Corporation® working next to us with a hammer drill. After talking to them, we rigged a system that used the Coleman© ULTI-Mite generator from the carpenter's tool box to power a hammer drill and create holes to allow us to insert the cameras' 15-foot extensions. Now we could work without having to move tons of material and crawl inside.

SFC Rostad uses a Broco torch to cut through a 3-inch-thick box beam.

On day 2, I asked for some help, and Master Sergeant Jose Gordon, senior enlisted adviser from West Point, was tasked to join me. I knew him from training sessions in the past, and I knew that he could handle the Broco torch.

The torches were working well. It took the ironworkers an average of 4 hours to cut the 5-inch-thick beams with their

SFC Rostad cuts a fire truck apart for transport.

Workers clear debris at Ground Zero.

torches, but it took only 40 minutes with the Broco. It burns at 10,000 degrees Fahrenheit versus the oxyacetylene torch's 1,000 to 1,200 degrees. We can backpack ours to the work site when needed or use the larger, standard K-bottles on the fringes or from the cage hanging from a crane.

As part of the mission, we advised the city on techniques that we, as combat soldiers, use to gain entry through obstacles. The ironworkers were fantastic, but they are more accustomed to building things than destroying them—and when they do destroy something, it is not usually a building that has dropped 220 acres of debris. Box beams that were 150 feet in the air in the vicinity of the underground retaining wall that keeps the Hudson River out of the entire subway system were giving them problems. They were worried that if the beams were cut enough to allow them to drop easily, they would fall back on the people doing the cutting. After performing a site assessment (target analysis), we felt confident that we could bring the 40 tons of steel down safely. We met with city representatives, briefed the plan, and gave a live demonstration of the torch's capabilities. The next morning, we cut down the sections of beams.

A civilian uses a hammer drill with generator to drill concete.

All active duty military personnel were pulled out of the World Trade Center site by 5 October. We were the last to leave. By that time, about 400 police, firefighters, and ironworkers had been trained on the Broco torch system, and about 300 had been trained on the handheld thermal cameras and infrared pole cameras. We were concerned that after we departed, the technology that we had left behind would not be used. However, an officer from the police department's Emergency Service Unit called to tell me that they are using the gear more now each day than they did during the entire 3 weeks we were there.

I want to take a moment to pay homage to the heroes of New York City. We arrived, helped for a little while, provided some capabilities that they did not have, and then left to resume our normal duties—whatever they might be. But there are thousands of people in New York and across the country who stopped working and drove, walked, ran, and probably crawled to help. These people lost loved ones or came to help strangers, just because they are fellow Americans. They are sleeping on cots donated by the Red Cross—or in their cars. They were there when I arrived, and they are still there. These people make you proud to be a soldier. They are the reason we exist.

At the time this article was written, Sergeant First Class Rostad (now retired) was a 12B40 (combat engineer) training developer in the Maneuver Support Center Directorate of Training Development, Fort Leonard Wood, Missouri.

Forcible-Entry Rapid Runway Repair

By First Lieutenant William R. Elliott

2200 Hours (P-HR), 18 April 2004

Amid the drone of C-17 Globemasters, C-130 Hercules, and C-141 Starlifters, heavy-drop platforms slip into the wind and begin their descent. Seconds later, the first chalks of the 505th Regimental Combat Team, 82d Airborne Division, start filling the sky over an enemy-held international airport. The enemy has mined and cratered the main runway. The Airfield Assessment Team (AAT), comprised of two engineer equipment operators who are among the first on the drop zone, quickly reports the location and dimensions of two large craters.

As the brigade gathers, contact with the enemy begins in earnest. A specialized component of the 618th Engineer Company (Light Equipment) (Airborne), called the Light Airfield Repair Package (LARP), remains hidden—prepping men, weapons, and equipment in "Assembly Area Clear." Their mission is straightforward: conduct a combat parachute assault and perform airfield damage repair (ADR), formerly known as rapid runway repair (RRR), in support of a task force airfield seizure.

Intelligence reports of enemy vehicles massing north of the airhead travel through the command nets. The Immediate Reaction Company (IRC) from the 3d Infantry Division will arrive overhead at P+8. A minimum operating strip (MOS) is required to land them—and two 20-foot by 20-foot craters are in the center of the strip. The LARP is ready to take on the damaged runway and complete the mission.

The unique task of the 618th Engineer Company is to support the forcible-entry, airfield-seizure mission of the Division Ready Brigade, 82d Airborne Division. The 618th is continuously developing and maintaining the standards for ADR kits, LARP equipment, and prepared (concrete) and semiprepared (clay) crater repair procedures. The intent of this article is to—

- Explain the planning and execution methodology of the 82d Airborne Division's forcible-entry ADR.
- Differentiate between standard ADR and forward aviation combat engineering procedures in secure areas versus combat-expedient forcible-entry ADR in hostile objective areas.
- Discuss challenges inherent to complex and joint forcible-entry operations.
- Point out the relevance of combat-expedient forcible-entry ADR to the force projection imperatives of the Objective Force.

Mission Analysis

Airfield seizure, an essential and evolving mission of the 82d Airborne Division, is being steadily shaped by the increasing availability of prepared-surface international airports (for example, concrete runways). The division relies on an air-landed IRC, typically a 14-vehicle, balanced mechanized-armor company team, and is committed to evacuating its casualties—factors that impact the assault landing zone (ALZ), formerly known as the flight landing strip (FLS), selection in forcible-entry operations. These realities demand that the 618th Engineer Company maintain proficiency in concrete pavement crater repair.

The LARP is a capability-based organization. Its composition varies according to mission specifics such as the type of ALZ, number of pallets available, and engineer parachute allocations (see Figure 1, page 8). It generally consists of 8 to 16 personnel and 7 platforms for airdropping vehicles and equipment.

The current operations plan (OPLAN) calls for the insertion of Team Recon, which should include the AAT, at P-48. A runway assessment by Special Operations Forces/ Long-Range Surveillance Detachment (LRSD)/AAT must satisfy the LARP's information requirements and help determine the final composition of the LARP (or medium airfield repair package [MARP]/ heavy airfield repair package [HARP]). The current LARP is optimal for a no-notice 18-hour (N-HR) outload sequence. Additional vehicles would require an extended (X-HR) outload sequence.[1]

Soldiers from the 618th Engineer Company use the sand-grid method to repair a damaged airfield.

LARP Information Requirements

Mission:

- Number and type of aircraft required to support and for time/distance separation between lifts.
- Number of aircraft landing during initial assault (needed to determine compaction/California Bearing Ratio [CBR] minimum standards based on aircraft load passes).

Enemy:

- Enemy MPCOA on the FLS.
- Method used to obstacle runway:
  - Air-delivered bombs.
  - Artillery.
  - Subsurface detonation.
  - Runway denial munitions.
  - Field-expedient methods.
- Types of mines/obstacles/explosives used.
- Unexploded ordnance (UXO) present.

Troops:

- Engineer parachute allocation.
- Location of heavy equipment point of impact (HEPI).
- Personnel (PAX) assembly instructions and equipment marking.
- LARP communication/reporting requirements.

Time:

- Proposed arrival time of IRC.

Terrain:

- Airfield dimensions and layout:
  - Number of aircraft it can hold in taxi area (maximum on round [MOG] by type of aircraft).
  - Type of runway surface:
    - Prepared (hardened) vs. semiprepared (clay FLS).
    - Surface conditions:
      - Ditches must be eliminated if > 6 inches deep.
      - Potholes must be filled if > 15 inches across and > 6 inches deep.
      - Rocks (in traffic areas) must be removed, embedded, or interlocked in a manner that will preclude displacement when traversed by aircraft.
      - Ruts should be a maximum depth of 3 inches.
      - Surface thickness of ALZ should be a minimum of 6 inches.
      - Tree stumps should be cut within 2 inches of ground.
- Number of each type of runway capable of heavy lift.
- Recent aircraft use of the FLS.
- Borrow pits availability, size, and content (quarries, clay pits, etc., to include turnaround times).
- Soil types in surrounding area.
- Water sources (compaction of clay caps).
- Water table depth in area.
- Construction sites in close proximity.

Weather:

- Weather conditions in the last 48 to 72 hours.

Civilian:

- Commercial vendors (concrete).
- Hangars available.
- Working power grid.
- Engineer construction equipment or barrier material (Class IV) around the airfield.

Figure 1

The brigade engineer, assistant brigade engineer, and light equipment platoon leader are charged with advising the maneuver commander on their ADR capabilities and limitations.[2] Supplying this estimate requires answering the following:

- When will the ALZ will be operational?
- How long will it take to repair the crater?
- How do you distinguish between the two?

The planning factor for accepting air lands is P+4:00 if there is no damage to the airfield. With damage, estimates become more difficult (see Figure 2). These benchmarks assume that airfield assessment, heavy-drop platform derigging operations, assembly, and movement to the crater occur relatively quickly. However, other variables complicate matters.

LARP operations begin as soon as possible during the seizure of initial assault objectives. In order not to interfere with the assault team, the LARP must remain in laager. This reduces the vulnerability of the LARP—a high-value target whose location constitutes an essential element of friendly information.

Consequently, the estimated time of ALZ readiness is entirely event-driven. "It is absolutely critical during mission analysis to use these factors in developing the task force operational timeline and execution matrix—P+4:00 ISN'T NECESSARILY THE ANSWER…."[3]

Mission Standards

According to Training Circular (TC) 5-340, *Air Base Damage Repair (Pavement Repair)*, "The sand-grid repair method, with a cover of fiberglass-reinforced polyester (FRP) mat, is designed to withstand …200 sorties of a C-141B and 300 sorties of a C-130."[4] "For rapidly deployable forces…the sand-grid method is the emergency repair solution. Army engineer units, especially light, airmobile, and airborne, should train with the sand-grid method since it is easily emplaced and provides an acceptable emergency repaired surface. The sand-grid method is lightweight and air transportable."[5]

Concrete Crater Repair

The LARP NCOIC continuously multitasks his crater and equipment teams, ensuring that concurrent work is performed. A trained crater team quickly executes the following:

- Removal of all oversized debris material (any material with any one measurement in excess of 12 inches, or wet/sticky material), identification and removal of upheaval (pavement upheaved from the original pavement surface from the ground shock effect of the explosives used to produce the crater), and rebar. Water-filled craters that must be drained and high-water tables significantly increase repair time.
- Compaction and leveling of crater to 16 inches below the original pavement surface, which precedes installation of two layers of 8-inch-thick sand grid. This is the most time-consuming segment.
- Assembly, emplacement (over the repaired crater), and securing of foreign object and debris (FOD) cover to the airfield surface.

Organization

Command and Control

"The seizure of an airfield is an extremely complex and dangerous operation (creating) an environment where strict command and control are essential."[6]

The LARP is difficult to understand using standard Army unit designations. Although often referred to as a team,[7] the LARP size actually ranges from squad (+) to platoon (-). The principle of span of control is vital. By task-organizing the "package" into crater and equipment elements, the platoon leader and construction foreman retain accountability and are prepared for contact on hostile drop zones. The succession of command is the OIC, NCOIC, crater NCO, equipment NCO, and senior operator.

Personnel

The crater team performs the majority of the labor, using hand tools to work the crater and emplacing the FOD cover. The team members also serve as alternate operators. As a contingency measure accounting for heavy-drop operations, a two-man maintenance team accompanies the operators. For in-built redundancy, all personnel are trained and licensed on all LARP equipment.

Equipment

All LARP-essential equipment is organic to the 618th Engineer Company and maintained by its three light equipment platoons (see Figure 3, page 10). The ADR kit and fabricated

LARP — Light Engineer Platoon (-)
Estimated Repair Time for Prepared Surface Craters

Time estimates are actual repair time from *arrival at the crater*, not P+ Hour.

- 2 large craters: 15 feet in diameter X 6 feet deep (140 CYd) = GOAL: **8** Hours
- 1 large crater: 15 feet in diameter X 6 feet deep (70 CYd) = GOAL: **6** Hours
- Small crater: 5 to 15 feet in diameter X 4 feet deep (26 CYd) = GOAL: **4** Hours
- Spalls: Up to 5 feet in diameter X 6 inches deep = 3-4 spalls/hour

Note: Large and small craters have damage that penetrates the pavement surface and have disturbed the subbase material. Spalls are similar to potholes with a damage area of 5 feet or less in diameter that do not penetrate the pavement surface to the subbase material.

Figure 2

Essential LARP Equipment (1 each)

Equipment	Airdrop Platform	Purpose
100% Organic to Light Equipment Platoon		**(Built-In Redundancy) Primary/Alternate**
Scoop loader (950BNS)	24 feet	1. Excavation 2. Haul
SEE (FLU 419) pavement breaker (sweeper attachment in lieu of bucket optional)	24 feet	1. Upheaval removal (hydraulic tool attachment) 2. Excavation 3. Debris removal
DEUCE (DV100)	24 feet	1. Excavation 2. Upheaval removal (hydraulic tool attachment)
FMTV dump truck	24 feet	1. Haul (When rigged for a heavy drop, 2,000 pounds of spall repair material [forty 50-pound bags] are loaded as ballast in the dump body.)
Z-Lite vibratory roller (smooth drum)	24 feet	1. Compaction 2. Grading (limited FOD removal capability with blade)
RRR Kit The air-transportable ADR kit was developed and evaluated by the WES to provide all materials and equipment for conducting a successful repair of craters in pavements. All items in the repair kit are packaged in a wooden crate, skid-mounted to allow for mobility both on the ground and in the air-deliverable mode. The kit weighs about 5,200 pounds and contains sufficient materials to repair a crater that is 25 feet in diameter.	24 feet	**General:** ▪ A self-contained ADR kit has the required materials to repair one 25-foot crater. ▪ A 24-foot airdrop platform containing two RRR boxes and two boxes for ballast. ▪ Rigged and maintained at the heavy-drop rig site, Fort Bragg, NC. **Basic Contents:** ▪ Sand grid: eight 20- x 8-foot sections ▪ FRP* matting: four full panels and four half panels. ▪ Mat anchor bolts. **Specifications:** ▪ 18.5 feet long x 7 feet wide x 19.5 feet high. ▪ About 5,200 pounds per box. **Capabilities** (two RRR kits): ▪ One 50-foot crater. ▪ Two 24-foot or smaller craters.
FAS Box	16 feet	**POL:** ▪ 30w lube oil - 10 gallons ▪ 15w40 lube oil - 5 gallons ▪ Grease, auto - 5 gallons ▪ Antifreeze - 5 gallons **PLL:** ▪ Z-Lite tire (on rim) ▪ Loader tire (on rim) ▪ SEE tire (on rim) ▪ 5-ton tire (on rim) ▪ Additional PLL lines: 50 **Special Tools:** ▪ Rakes, shovels, brooms, etc. ▪ Gas-powered hand tamper ▪ Rescue (steel-cutting) saw ▪ Hydraulic saw attachment ▪ Sump pump - hydraulic - SEE 5-gallon water cans (5) ▪ Generator - 1.5 KW

* The FRP mats furnished in the kit are 18 feet long by 6 1/2 feet wide by about 1/2 inch thick. The mats consist of two layers of fiberglass impregnated with polyester resin. On one side and one edge of the mat, 2 1/2-inch-diameter holes are provided so either anchor bushings or bolt bushings can be inserted into the holes. The selection of bushings is dependent on whether the mat's edge is being anchored to the pavement or being connected to another mat. On the opposite side and end of the mat, 3/4-inch diameter threaded holes are provided by bonding circular metal plates containing threaded holes (nuts) to the bottom of the mat. The mats are joined with 1-inch-long by 3/4 inch-diameter bolts. Half panels, which are 8 feet 8 inches long and 6 1/2 feet wide, are also furnished to allow stagger of end joints. The top surface of the panels contains a green antiskid coating to prevent glare and provide an adequate coefficient of friction especially during inclement weather. (Reference: GL 90-1, page 12, paragraph 12).

Figure 3

aerial supply (FAS) box (or toolbox) remain deployable for real-world contingencies by the platoon habitually associated with the current Division Ready Brigade. Training versions of both are available to the platoon during its intensive training (green) cycle. Manpacked special equipment includes, but is not limited to, airfield cone penetrometers, hot-wire kits, and bolt cutters.

Challenges

There is no authoritative doctrine for the repair of prepared surfaces on captured enemy airfields. The 82d Airborne Division's ADR procedures are a compilation of available reference material and training experience. The 618th Engineer Company and the 887th Engineer Company, in habitual association with divisions with forcible-entry missions, need updated Joint Service doctrinal sources that take into account close operations.

After the initial airdrop, the sustained combat power of airborne forces depends on resupply by air. Any interruption in the flow of resupply aircraft can cause a potential weakening of the airborne force. TC 5-340 defines RRR as "the emergency repair of the *air base* paved surfaces...."[8] The captured ALZ is not an "air base" requiring a general engineering effort; it is the task force's lifeline, calling for a combat mobility effort.

Current doctrine for ADR (TC 5-340) is based on the Cold War threat. Restoration of bomb damage of existing U.S. Air Force bases in Europe led to Army and Air Force responsibilities being defined under AR 415-30 and AFR 93-10, *Troop Construction and Engineering Support of the Air Force Overseas.*

Air Force responsibilities include the following:

- Emergency repair of war damage (attack +4 hours).
- Force beddown of Air Force units and weapon systems.
- Base operations and maintenance.
- Crash rescue and fire suppression.
- Construction management of emergency repairs.

Army responsibilities include the following:

- Assistance to the Air Force for emergency repairs.
- Beyond emergency repairs (semipermanent) (post attack +4 hours).
- Assistance to the Air Force with force beddown.
- Construction management of Army assets.
- Development/acquisition of air bases.

The last Army responsibility listed above—development/acquisition of air bases—is the forefather from which the current forcible-entry ADR mission is derived. This mission assumes greater importance due to its relevance to the Interim Brigade Combat Team (IBCT) concept. Without seizure and repair of a concrete runway that can support C-17 traffic, the IBCT will not be able to conduct operations. It is important to note that neither the sand-grid repair nor any other RRR method has been certified to support sustained C-17 traffic. The likely configuration of the extremely heavy C-17 will result in an aircraft that is nearly three times as heavy as a C-130.[9] At this time, the Engineer Research and Development Center (ERDC) and the Engineer School recommend that runways used by C-17s be repaired using semipermanent or permanent methods (stone and grout or concrete cap methods). Please contact the Engineer School Department of Instruction for developments on this topic.

Just as Army doctrine encompasses the spectrum of operations, Army engineer doctrine should provide guidance across the range of missions. Mobility tasks in areas where enemy contact is likely need to address tactical movement and security. "Establish Jobsite Security" (Training & Evaluation Outline [T&EO] 05-3-0904) is not adequate. Factors of time and resource constraints must be addressed. This is construction in close vicinity to combat. Engineer T&EOs must reflect this.

A prototype T&EO, directed at forcible-entry ADR conducted under combat conditions, is currently in use by the 618th Engineer Company and has been submitted to the Doctrine Development Division, U.S. Army Engineer School. For more information, contact Commander, 618th Engineer Company (LE) (ABN), Fort Bragg, North Carolina 28310, (910) 432-2527/9577, DSN 239-2527 / 9577.

Transformation

The Army VISION: People, Readiness, and Transformation, reads as follows: "The Objective Force: combat capable brigade anywhere in the world in 96 hours; a division on the ground in 120 hours; five divisions on the ground in theater in 30 days."

For a contingency force, an operational airfield is the initial decisive point for any campaign. The preceding tactics, techniques, and procedures are adaptable to the necessities of future strategic mobility requirements. Simplicity in airfield crater repair has been a hallmark of sustaining the combat power of a division ready brigade of the 82d Airborne Division.

The same expediency will be required to place an IBCT in theater within 4 days. Current estimates require 12 fully functional airfields to deploy an IBCT division within the 5-day (120-hour) window that the Chief of Staff of the Army has envisioned (see Figure 4, page 12).

IBCT engineers facing an unopposed-unassisted entry may be required to conduct forcible-entry ADR based on the following:

- The C-17 Globemaster III aircraft allows direct access to additional airfields worldwide and can carry outsized equipment (such as the Interim Armored Vehicle LAV III), thus permitting faster force closure.
- The primary airlift challenge is a lack of airports—not the lack of aircraft. Consequently, maximum throughput at limited airports is paramount.
- Large concentrations of soldiers and equipment at reception areas represent attractive targets to terrorist threats.
- Initial repairs may consider a subsequent transition to "beyond emergency repair" if time and resource constraints do not exist.

"Deployable - the Objective Force was a credible combat force capable of simultaneous deployment and employment, exploiting multiple air and ground entry points, using a variety of methods."[10]

The expeditionary qualities of the Interim Force, slated to quickly become five to nine brigades, heightens the significance of forcible-entry ADR to the 15 to 27 newly transformed engineer companies as well. If "force projection and entry operations require investments now in advanced...airlift capabilities,"[11] then a corresponding relook by U.S. Army engineers at ADR is essential to meet this end.

Conclusion

The methodology of the 82d Airborne Division's ADR is flexible and combat-focused. Light equipment airborne and air assault companies provide a relevant model for future IBCT engineers supporting future strategic deployments. Successfully analyzing and executing a mission depend on the

Critical Airfield Dimension/Criteria	
C-130 Length: 3500' + 300' Lead Overrun + 300' Trail Overrun = **4100'** Width: 80' (with shoulders) Lateral Clear Zone Slope: 5:1 for 75', 10:1 for 150'	**C-17** Length: 3500' + 300' Lead Overrun + 300' Trail Overrun = **4100'** Width: 110' (with shoulders) Lateral Clear Zone Slope: 5:1 for 75', 10:1 for 150'
Bottom Line: To assess, clear, repair, and open for airland an FLS is a combined-arms and joint operation.	
What is sufficient MOS?	Operational waivers for specific locations/missions obtained through Air Force Major Command/DO
What is a sufficient runway surface repair?	Certified by CCT/STT
What will the Air Force land on in wartime?	Certified by CCT/STT

Figure 4

Army engineer understanding of U.S. Air Force aircraft capabilities and landing requirements. ADR on hostile airfields requires tactics, techniques, and procedures not fully addressed by our doctrine today. Changing threats and probable hot spots continue to drive the 618th Engineer Company, 307th Engineer Battalion, to develop and refine its forcible-entry ADR.

* * *

0600 Hours (P+ 8), 19 April 2004

The distant rattle of small-arms and mortar fire signals that the battle for the international airport is not over. The airhead line expands and the IRC birds are on station. The LARP leaders conduct a link-up with the Air Force Combat Control Team. After the special tactics squadron inspects the repaired MOS to ensure that surface roughness criteria has been met (repairs are within 3/4 inch of the original pavement surface), the MOS is certified, giving the aircraft the green light to land. Airborne engineer effort proves central to its success.

First Lieutenant Elliott is the battalion construction officer/ S3 Air for the 307th Engineer Battalion. He previously led 3d Platoon, 618th Engineer Company, in support of the 505th Parachute Infantry Regiment, and served enlisted in 1st Battalion, 75th Ranger Regiment. 1LT Elliott is a graduate of Officer Candidate School and holds a bachelor's degree in international relations from Syracuse University.

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[8] TC 5-340.

[9] Jeb S. Tingle, E.I., Research Civil Engineer, U.S. Army Corps of Engineers, Engineer Research & Development Center (ERDC), Geotechnical & Structures Laboratory.

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Assessing Engineer Priorities in the Division Capstone Exercise

By Major Eugene Snyman and Lieutenant Colonel Jeffrey A. Bedey

The Division Capstone Exercise (DCX), a key event in the Army digitization strategy, provided the Maneuver Support Center (MANSCEN) a vehicle to examine organizations and systems that soldiers will use as the Legacy Force develops in parallel to the Interim and Objective Forces. MG Aadland, Commanding General, MANSCEN, and Director of the Maneuver Support Center Battle Lab (MSBL), focused the MSBL, as the lead MANSCEN agency for experimentation, on five engineer issues throughout the exercise. The "Top Five" included the size of the digitized division's engineer battalion, the engineer logistic support structure, obstacle situational awareness in a digital environment, Digitized Topographical Support System (DTSS) and terrain team redesign, and engineer command and control (C2) structure in the new division. While great progress was made on many aspects of these issues, full resolution will require more work.

DCX Background

The DCX, conducted in September 2001, marked a significant step in the Army's transformation campaign. The Force XXI Campaign Plan consisted of complementary efforts of experimentation at each echelon, beginning with the task force and moving through the division. Plans to digitize III Corps are tentatively set for FY04. The campaign's primary focus was on new organizational design and battle command concepts. Central to this new force design was the ability to exploit information. In March 1995, the Training and Doctrine Command (TRADOC) identified the 4th Infantry Division, Fort Hood, Texas, as the unit to undergo experimentation with Information Age concepts and technologies. In early 1997, TRADOC conducted the Task Force XXI Advanced Warfighting Experiment, focusing on a digitally equipped, brigade-size experimental force (EXFOR). Later that year, the 4th Infantry Division participated in the Division Advanced Warfighting Experiment. It validated the hypothesis that digitization improves lethality, survivability, sustainability, and tempo and that a smaller digitized Force XXI (FXXI) division was as effective as a larger Army of Excellence (AOE) division. The new division structure approved later that year had 3,000 fewer personnel and 25 percent fewer combat systems. The engineer brigade was cut and engineer battalions became organic to maneuver brigades.

The purpose of the DCX was to demonstrate and assess the warfighting capability of the Force XXI division across a full spectrum of combat stability and sustainment operations. Additionally, the exercise validated the operation and organization (O&O) plan of the new division and sought to integrate command, control, communications, computers, and intelligence (C4I) operations at all levels over extended doctrinal distances. Although it was a component of the Army experimental campaign, the DCX was not a "test" or a pass/fail event but a demonstration designed to provide evaluation, validation, and feedback on the FXXI division design.

The DCX was a two-phase exercise evaluated by the TRADOC Analysis Center and Battle Command Training Program (BCTP). The first phase, conducted from 31 March to 14 April, was a National Training Center (NTC) rotation. The 2d Brigade Combat Team conducted a three-battalion rotation using adapted Bosnian terrain. The second phase (15 to 19 October) was a Corps Battle Simulation exercise conducted at Fort Hood with brigade and higher tactical operation centers (TOCs) deployed and mobile.

DCX Top Five Issues

Engineer Battalion Size

Although the capability of the division remained the same under the new O&O plan, engineer battalion commanders in the new division experienced a significant reduction in structure when compared to the previous AOE battalions. As previously stated, a fundamental component of the FXXI design theory was that digitally driven situational awareness would facilitate greater capability with a smaller force. Also, it was envisioned that this division would be more offensively oriented and would therefore require fewer survivability assets, which translated to fewer armored combat earthmovers and elimination of small equipment excavators. Further, the maintenance and support slice was pulled out of the armor, infantry, and engineer battalions and consolidated in the support battalions.

The real issue arose with the omission of the Grizzly. The FXXI engineer battalion was designed to have the Grizzly as a breaching enabler, which—because of its obstacle-reduction capability—further reduced the number of required sappers. In fact, with this key enabler, each platoon had only two squads. With the Army's decision to cut Grizzly funding, the U.S. Army Engineer School began efforts to restore personnel strength to compensate for the lost enablers.

In preparation for the DCX NTC rotation, planners determined that the battalion lacked requisite breaching capability and supplemented the force with a company of AOE Corps engineers. While the sapper battalion performed admirably, the decision to augment the organic engineer capability underscored the requirement for a more robust battalion.

This issue was essentially resolved with the decision to field the Bradley fighting vehicle (BFV) to the engineers. An increase in personnel would accompany BFV fielding, which—when combined with the strength of the proposed Engineer Support Company (see next issue)—will actually exceed the AOE battalion strength. While some subordinate issues (number of squads, potential sapper reconnaissance role) must still be worked through, the new force structure is adequate and efforts will now focus on the Interim and Objective Force structures.

Engineer Support Element

The engineer CSS structure in the FXXI division consists of an engineer support element (ESE) within the base support company (BSC) of the forward support battalion (FSB). The DCX NTC rotation exposed some inadequacies of this new structure. The BSC, located in the brigade support area (BSA), was unable to fully support the ESE, located in the brigade forward support area (BFSA). The ESE is only resourced for support operations with one warrant officer (90A), who is essentially consumed with maintenance. In addition, Class IV and V transportation requirements, which require the ESE to effectively leverage BSC transportation assets, were not adequately met. Although supported maneuver task forces failed to properly allocate lift and haul assets, a shortage of these assets in the ESE contributed to Class IV repositioning shortfalls. The ESE distribution section has three heavy expanded-mobility tactical truck (HEMTT) load-handling systems (LHSs), but they were fully taxed with internal requirements. Key Class IV and V moves were not accomplished in a timely manner, and the ESE was unable to maintain the backup Class IV stocks. Further, the HEMTT crane lift capability was nearly exceeded when lifting individual Volcano reloads. Finally, the support companies of the armor and infantry battalions had nearly twice as many mechanics and PLL clerks as the ESE. Previous structures allowed some engineer machanic redundancy. Under this structure, commanders had no flexibility, especially during critical task organization changes when support requirement expand.

Previous articles published in both *Engineer* ("Facing The CSS Challenge," May 2000) and the *Army Logistician* further expounded on these issues. As attention on the ESE problem increased, so did the defense of a more robust engineer support structure. Recommended solutions included the addition of a support operations cell, an increase in PLL and maintenance personnel and skill levels, and an increase in HEMTT LHS vehicles. This structure concept, essentially a company-size element, has been approved by MANSCEN and is currently gaining momentum at TRADOC and the Combined Arms Support Command.

Obstacle Situational Awareness

The power of situational awareness experienced by commanders in the FXXI division should not be understated. The ability to immediately communicate the location of obstacles to adjacent organizations and contribute to a common operational picture is a tremendous capability. However, the DCX showed that situational awareness must still be refined.

Loss of life and combat power during DCX I was partly due to the soldier's overreliance on digital systems that improperly tracked obstacle location. Increased mine fratricides resulted from two factors:

- FXXI division structure resulted in greater proportion of scatterable to conventional mines.
- A lack of operator obstacle awareness.

Although the Army Battle Command System (ABCS) in general, and the Maneuver Control System (MCS) and the Force XXI Battle Command Brigade and Below (FBCB2) in particular, significantly increased the overall situational awareness, the MCS and FBCB2 did not easily or accurately facilitate the dissemination of obstacle situational awareness to platform level.

System problems fall into two categories. First, connectivity between the lower (essentially below brigade) and upper (brigade and above) tactical Internet (between FBCB2 and MCS) must be seamless. Currently, although some obstacle situational awareness exists with FBCB2, the data does not effectively transfer to MCS. Hence, brigade and above TOCs have extremely limited minefield visibility through MCS. At these echelons, obstacle overlays must be manually created then manually sent to each intended recipient. The 4th Infantry Division engineers had some 40 to 50 addresses to "fat-finger" into MCS each time the overlay was updated. The real-time obstacle awareness expected from a digital environment was nonexistent. Further, obstacle plans generated at division, brigade, and task force level do not digitally transfer from the MCS to the FBCB2 platform.

Secondly, the FBCB2 does not have an input screen (called a Joint Variable Message Text) that allows obstacles to be tracked and updated using the doctrinal obstacle number. Essentially, an obstacle identified or created by any FBCB2 operator will automatically populate all other FBCB2 screens, but the ability to store, update, query, or consolidate obstacle information is very limited.

The MANSCEN Directorate of Combat Developments (DCD), the Maneuver Support Battle Lab, Warrior-T, TRADOC System Manager-MCS, and TRADOC System Manager-FBCB2 are developing a thorough campaign plan to ensure that future updates and system developments address these problems. Additional requirements include an FBCB2 screen that automatically updates a relational database that is keyed off the doctrinal obstacle number. This would allow each status update to override existing data on a particular minefield, thus keeping minefield records current. This database must then automatically update an overlay that is periodically auto-posted to other MCS screens. Data entered by recon elements or sappers on their FBCB2 screens would essentially create an automatic, real-time, dirty battlefield overlay.

Digital Topographic Support System

The FXXI structure created a brigade-level terrain analysis team fully supported by the DTSS. During both phases of the DCX, considerable progress was made in the timely delivery of terrain visualization products to the maneuver commanders and staffs. The division terrain team successfully received a digital terrain data update of several gigabytes via satellite from the National Imagery and Mapping Agency (NIMA). This validated one aspect of the reach-back capability proposed in transformation discussions.

Many examples exist that illustrate the general movement toward consistent interest, understanding, and utilization of terrain visualization among maneuver commanders. At the division level, the assistant division commander-maneuver (ADC-M) specifically requested a reverse line-of-site analysis to assist the G2 in identifying likely opposing force (OPFOR) movement routes and support-by-fire positions. In addition, the terrain team at the DTAC was provided recent OPFOR indirect firing vectors. Using line of sight, the G2 was able to recommend focused reconnaissance in these areas. At the brigade, three-dimensional perspectives, which helped commanders understand complex terrain through which they were attacking, were included in the brigade operations orders. These perspective views and other terrain visualization products were made available to the battalion commanders through the use of the terrain team's Web site.

Improvements to this capability will fall into three categories. First, there are training issues that need to be addressed at the Engineer School. Terrain teams need tactics, techniques, and procedures to increase the proficiency of the complex and perishable skills required of an 81T terrain analyst. Since there are more customers (division artillery, engineer group) than terrain teams, their work and products must be centrally managed. Finally, engineer staffs and ABCS users need training to know what products to request, when in the planning and execution cycles to request them, and how to use these geospatial products. Engineers must continue to be persistent advocates of geospatial solutions to maneuver problems.

Secondly, there are technical issues with the way geospatial products are stored, managed, and used in the TOCs. Proponency has not yet been established for the map server on which all maps are stored and which is integrated into the ABCS architecture. Although the MANSCEN DCD has the expertise, the Engineer Regiment cannot, and should not, attempt to solve this alone. ABCS also lacks an effective common tool kit to view and manipulate map data across all ABCS systems. The Project Management Office for Combat Terrain Information Systems is the material developer working with TRADOC Program Integration Office - ABCS to resolve both of these issues.

The third issue involves dissemination of data from national sources to combined arms commanders. Although the NIMA-to-TOC transfer of map data worked, it was not without challenges. The Global Broadcast Service (GBS) that facilitates the data transfer at the TOCs was a TRADOC Program Integration Office for Terrain Data (TPIO-TD) initiative, dependent on contract support. The Engineer School is working on plans to educate other maneuver community members on this critical data transfer capability.

Engineer Command and Control

Perhaps the most controversial change to the FXXI Division is the replacement of the engineer brigade with an O-6 led staff element. The weakness of this structure is two-fold:

- There is a lack of a single engineer with command authority to direct organic engineer effort or mass engineer effort in accordance with the division commanders' intent.
- There is a C2 void when integrating multiple engineer units into the digitized division.

In the DCX, there was no single C2 node responsible for integrating engineer forces, which severely limited C2 options. Maneuver brigades were forced to accept all echelon above division (EAD) engineers working forward in the division which strained the limits of their span of control. This resulted in the main-effort brigade combat team having a total of eight battalions (3 maneuver, 1 field artillery, 4 engineer) under its direct control; there are normally three maneuver battalions, a DS artillery battalion, a support battalion, and an engineer battalion.

The engineer group task organized to the division was positioned with the division rear command post or division support element (DSE) to allow control of engineer units to the rear of the brigade combat team boundaries. This positioning prevented the group from influencing the forward fight due to their analogue communication in the expanded battlespace of the digital division. Further, the breadth and depth of the group's area of responsibility created communication problems preventing it from maintaining situational awareness of its organic units and accurately monitoring logistical requirements.

The division engineer (DIVENG) was staffed and resourced to function as a planning node, working for the commanding general and the G3, not a command and control node. The DIVENG staff primarily tracked mobility (enemy obstacles, breaches, and bridging assets). The staff did not have the responsibility, nor was it organized, to oversee the logistical and training requirements of organic or EAD engineer units. The task of anticipating the classes of supply requirements and specialty-specific training requirements fell on the brigade combat team maneuver headquarters. With the EAD group in the rear out of communication range of its subordinates, there was no single headquarters tracking status of all engineer assets to advise the division commander of engineer requirements and/or capabilities. With no engineer command and control node organic to the division, there is a lack of engineer integration between the maneuver brigade commander's fight and the EAD engineer group commander's work line.

A change to the force allocation rules could create a partial solution. A second EAD engineer group would allow the commander to focus forward while the other worked traditional rear area missions. At least one of these groups, however, would need to be digitized and given a habitual relationship with the division much like the old Wartrace concept. It is true that habitual association is not the same as a tenant organization—"on the team" is not the same as "in the family."

A more viable option is to embed, in the division, a command and control capability with resident digital architecture enablers designed to receive and integrate EAD units, then command a tailorable maneuver support package up to brigade size. This node, serving as an organic and integral component of the division commander's staff, would have four primary responsibilities:

- Plan, integrate, and employ any and all assets configured to execute division-level mobility, survivability, contermobility, sustainment, or geospatial operations conducted forward in the battlespace.
- Coordinate with engineer groups or brigades operating in the division rear area.
- Provide training and maintenance oversight of the division's engineer assets.
- Provide the flexibility to serve as a C2 node for the division during stability operations or other unique mission sets.

Critical to the functionality of this node would be its core staff and digital communication enablers. Staff sections, with the full suite of ABCS architecture, would be augmented with personnel appropriate to the mission, yet have resident staffing robust enough to maintain garrison planning requirements and expertise in digital architecture. This unit would maintain detailed contingency plans with support and reception, staging and onward integration (RSOI) units in order to quickly assimilate these required units into the division's operations.

Unfortunately, evidence available from DCX to support claims of inadequacies in the new structure was, at best, circumstantial. Certainly, numerous historical examples highlight the neccessity of support from units not organic to the division. Ad hoc brigade-level engineer organizations are common. And, since the concept is sound regardless of the size of the unit of action, the requirement to absorb support will exist in the Interim and Objective Forces as well.

Conclusion

The DCX provided the opportunity to observe and make recommendations regarding the employment of engineers in the mechanized digital division and to track and influence important aspects of engineer integration. Clearly, these issues are in various stages of resolution and require additional attention, especially as they relate to the Interim and Objective Force concepts.

Major Snyman is Chief, Heavy Forces Division, Maneuver Support Battle Lab, Fort Leonard Wood, Missouri. He previously commanded the 535th Engineer Company (CSE), 130th Engineer Brigade, Hanau, Germany. MAJ Snyman is a graduate of the Command and General Staff College and holds a master's degree in military science from the Command and General Staff College.

Lieutenant Colonel Bedey is Chief, Department of Instruction, U.S. Army Engineer School, Fort Leonard Wood, Missouri. He previously commanded the 299th Engineer Battalion, 1st Brigade, 4th Infantry Division, Fort Hood, Texas. LTC Bedey is a graduate of the Command and General Staff College and holds a master's degree in construction management from Colorado State University.

(Clear The Way, continued from page 2)

have decades of experience in the basic tenets of HLS. As a major player in the National Disaster Response Plan, we have a long history of supporting state and federal agencies and have gained valuable experience in responding to natural and man-made disasters across our nation and territories, as well as throughout Central America, the Caribbean, and the Pacific Rim. At this moment, Engineers are supporting JTF-6 in its critical mission to enhance security on our nation's borders. Since 11 September, the U.S. Army Corps of Engineers (USACE), North Atlantic Division and 249th Engineer Battalion (Prime Power), have committed to massive disaster relief and infrastructure repair efforts in New York City and Washington, D.C. The Engineer School has much to draw upon—from within our great corps, from sister services with whom we work and train, and from our allies who have seen similar attacks against their homelands—to set the course for training and concept development that must serve the HLS priorities of our military as it transforms to the Objective Force.

The Army and Engineer Corps of today are forging ahead with Transformation efforts that now must not only create an Objective Force in record time but also define a new force to address the immediate needs of HLS and antiterrorism and create blueprints to overcome asymmetric threats and win future wars. Historical lessons can temper our azimuth for our strategic compass as we accelerate this quest to defeat 21st century threats and terrorism.

The road ahead will not be easy, as Winston Churchill's words solemnly echo how Britain overcame its darkest hours during World War II. "You ask, what is our aim? I can answer in one word: victory—victory at all costs, victory in spite of all terror, victory however long and hard the road may be; without victory, there is no survival."

For more than 200 years, men and women—civilians and soldiers—have served the Army Corps of Engineers. In peace, whether the designer of our nation's new Capitol building in 1840, a dredge boat pilot in 1875, a lock master in 1950, or an environmental Engineer today; whether an astronaut aboard the space shuttle in 2000, or an explorer of the western frontier in 1806—Engineers have served. In war, whether in the deserts of Saudi Arabia, the jungles of Vietnam, the mountains of Korea, or the islands, forests, and plains of two world wars; whether on our own soil throughout the 18th and 19th centuries, in numerous conflicts in between, or at the ruins of the World Trade Center in 2001—Engineers have served. This Regiment is still made up of a diverse group of incredibly dedicated Americans who, when called upon, have fought our wars and ensured our peace. They are the visionaries who built, and continue to build, our nation. The story of the U.S. Army Engineers is nothing more than the history of individual Americans and nothing less than the history of America. And now, the vital and varied HLS missions, roles, and capabilities of the Engineers will help build the new legacy of its great contribution to our nation's survival, stability, and security in the 21st century.

Essayons.

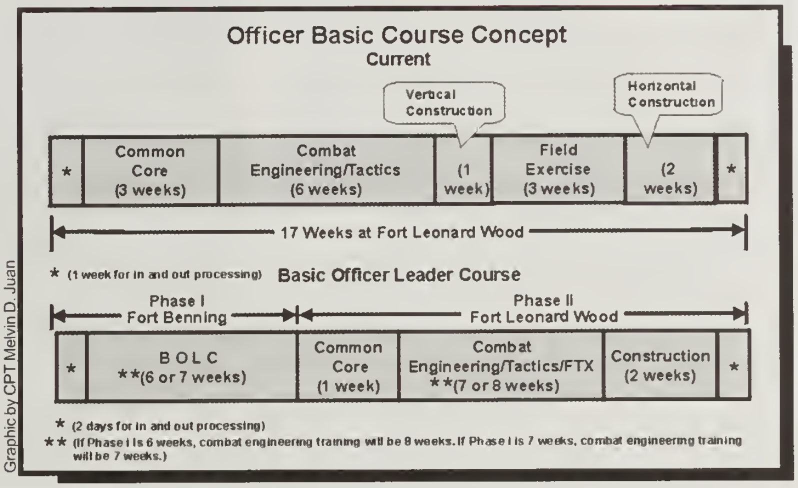
Engineer Officer Basic Course Transformation

By Lieutenant Colonel Susan Myers, Captain Heather Levy, and Mr. Roy Blackburn

The Engineer Officer Basic Course (EOBC) is undergoing significant restructuring in FY03 and will be called the Basic Officer Leader Course (BOLC) Phases I and II. BOLC will bring together newly commissioned lieutenants from all branches to learn fundamentals of leadership, as well as provide branch-specific training. This article outlines the changes in EOBC as it transitions to this two-phase BOLC. Phase I, a 6- or 7-week leadership and common-core course, is taught at Fort Benning, Georgia. Phase II, the 10- or 11-week engineer-specific training, is taught at Fort Leonard Wood, Missouri.

Basic Officer Leader Course

The transition of EOBC to a shorter (10-week) program of instruction was predicated by the development of BOLC Phase I by the Training and Doctrine Command (TRADOC). Phase I focuses on leadership, common-core classes, and basic soldier skills. It includes counseling, land navigation, weapons qualification, physical training, and common-task training. More than three-fourths of the instruction is in the field—tactics, weapons qualification, and situational training exercise lanes. The garrison training includes counseling and leadership doctrine, as well as classes in maintenance, supply, communication, and preventive medicine. In addition, students conduct physical training, road marches, combatives, and the confidence course. After completing BOLC, Phase I students will move on to their respective branch schools for Phase II.


Officer Basic Course Concept
Current
Vertical Construction
Horizontal Construction
*
Common Core (3 weeks)
Combat Engineering/Tactics (6 weeks)
(1 week)
Field Exercise (3 weeks)
(2 weeks)
*
17 Weeks at Fort Leonard Wood
* (1 week for in and out processing)
Basic Officer Leader Course
Phase I Fort Benning
Phase II Fort Leonard Wood
*
B O L C **(6 or 7 weeks)
Common Core (1 week)
Combat Engineering/Tactics/FTX **(7 or 8 weeks)
Construction (2 weeks)
*
* (2 days for in and out processing)
** (If Phase I is 6 weeks, combat engineering training will be 8 weeks. If Phase I is 7 weeks, combat engineering training will be 7 weeks.)

Graphic by CPT Melvin D. Juan

Transition From EOBC to BOLC

The EOBC 17-week program of instruction is divided into inprocessing, common core, combat engineering and tactics, vertical construction, field exercise, horizontal construction, and outprocessing. As the program of instruction is condensed and adjusted, the course will be reoriented into inprocessing, common core, combat engineering and tactics, field exercise, construction, and outprocessing to eliminate duplication of BOLC Phase I training.

Common Core. This instruction, formerly 3 weeks, will be cut to just 1 week. Most classes cut from this phase of the EOBC will be covered in either BOLC Phase I or Phase II. Most course material—including military history, risk management, maintenance, and supply—will continue to be a part of the program of instruction.

Combat Engineering and Tactics. This segment, which is 7 weeks long, covers instruction in demolitions, bridging, mine warfare, and combined-arms tactics. This training culminates in a 4-day field training exercise that reinforces operations orders and emplacement and breaching of a complex obstacle.

Field Training Exercise (FTX). With the large amount of field time in BOLC, much of the common tactics, land navigation training, and platoon and squad missions have already been covered. The FTX will remain a 4-day, engineer-specific event with emphasis on complex-obstacle emplacement/breaching and stability and support operations. Recovery operations are also a significant part of the FTX—with inspections to ensure that personal equipment is maintained to Army standards. The cadre conducts detailed evaluations to allow students to provide feedback as they perform leadership roles.

Construction. This 2-week segment covers vertical and horizontal construction. It has largely remained intact, except for the loss of about 10 hours of instruction in site investigations and earthwork estimations. This segment includes training in project management, structures, utilities, concrete, drainage, road construction, and force protection.

Summary

Overall, students who are commissioned as engineer officers in FY03 and attend BOLC will receive similar quality engineer training as lieutenants who attend today's EOBC, with the addition of combined arms, hands-on, field-oriented training. Future students will receive additional training in terrain analysis, scatterable mines, and complex obstacles. The field training that will be eliminated from EOBC will be included in BOLC, with some additions such as the confidence course, combatives, and weapons qualification. BOLC reflects updates in the Engineer Regiment. BOLC will train our future lieutenants as warrior leaders—prepared to lead the way as engineers in battle.

Lieutenant Colonel Myers is the battalion commander, Captain Levy is the assistant S3, and Mr. Blackburn is a training specialist with the 554th Engineer Battalion, Fort Leonard Wood, Missouri.

249th Engineer Battalion (Prime Power) Responds to Terrorist Attacks

By Captain Hans J. R. Pung

On the morning of 11 September, terrorists launched a series of coordinated attacks against the United States that left our nation stunned. Both towers of the World Trade Center in lower Manhattan collapsed, killing and injuring thousands, and a fire raged in the Pentagon, the result of suicidal airline crashes. By the end of the day, the federal government had moved quickly to respond to the crisis, and the soldiers of the 249th Engineer Battalion (Prime Power) comprised a vital part of that response.

With President Bush declaring both New York City and Northern Virginia federal disaster areas, the 249th moved into action. Working under the direction of the U.S. Army Corps of Engineers (USACE), as part of the larger Federal Emergency Manage-ment Agency (FEMA)-administered Federal Response Plan, the 249th provided liaison support between the local power company and FEMA and assisted with electrical assessments and generator installation in areas directly impacted by the terrorist attacks.

Soldiers survey damage before emplacing a generator.

Early on 12 September, the battalion deployed a two-person Prime Power Action Team to Edison, New Jersey, to serve as action officers in the emergency power portion of the FEMA relief effort. The following day, the commander of the 249th led a team of prime power soldiers from both Fort Belvoir, Virginia, and Fort Bragg, North Carolina, to New York to assist the North Atlantic Division (NAD) of USACE and to serve as subject-matter experts for any power-related issues.

After meeting with the NAD forward commander, representatives from FEMA, and the local power company (ConEdison), the 249th provided an additional 21 soldiers to assess power needs and install emergency generators in lower Manhattan. Soldiers deployed from both Fort Belvoir and Fort Bragg on 16 September and spent the next 3 days helping ConEdison perform various electrical tasks within New York City. Some of the significant missions included assessing power and installing generators at multiple financial buildings (to include the New York Mercantile Exchange and the NASDAQ Electrical Hub) to ensure that the financial district would be powered and ready to reopen less than 1 week after the terrorist attacks.

Soldiers from the 249th worked with ConEdison to set up generators at medical triage facilities and transient lodging centers in support of the relief effort. To accomplish these missions in a more efficient manner, the 249th split its assessment/installation teams into day and night shifts, enabling electrical repairs to continue around the clock. By 18 September, most of the city's power was restored, and FEMA determined that the 249th was no longer needed to augment the local infrastructure. Accordingly, the soldiers redeployed back to their home stations that evening.

The 249th also contributed to disaster relief efforts at the Pentagon. On 12 September, the battalion deployed a two-person Prime Power Action Team to Arlington, Virginia, to assist the FEMA Emergency Response Team with any power queries it might have. The USACE representative on-site asked the team to determine the Pentagon's power requirements and recommend how to meet those needs. Fortunately, the Pentagon's electrical systems were largely intact after the attack and needed no external assistance from FEMA.

Their mission accomplished, the 249th soldiers redeployed to Fort Belvoir later that day. However, just 5 days later, the Military District of Washington requested assets from the 249th to consolidate the power needs of the entire relief effort located just outside of the Pentagon. To support this, the battalion deployed two of its 500-kilowatt, low-voltage generators to the site, along with personnel to install and maintain the generators. This mission is still ongoing, and the 249th will continue to support the disaster relief efforts as long as necessary.

In reaction to the tragic events of 11 September, USACE has been at the forefront of federal efforts to respond to this crisis. The Black Lions of the 249th Engineer Battalion have been a major contributing factor in the Corps's efforts and will continue to be our Army's primary resource for emergency power.

Captain Pung, assistant operations officer for the 249th Engineer Battalion, Fort Belvoir, Virginia, served with the 1st Armored Division Engineer Brigade in Germany and the 44th Engineer Battalion in Korea. A graduate of the United States Military Academy, CPT Pung holds two master's degrees from the University of Oxford in the United Kingdom.

Carrying on the Legacy of the Black Lions

By Lieutenant Colonel Anthony Vesay

It is an honor to collaborate on an article with one of our past 249th Engineer Battalion heroes—Colonel John K. Addison (Retired), the 249th's first commander. Here are some brief thoughts on his legacy and some comments on the history of the battalion—now the 249th Engineer Battalion (Prime Power). The unit has accomplished great things as it continues the proud history of the Black Lions.

History of the 249th Engineer Battalion Black Lions

The lion, suggested by the Belgian coat of arms, alludes to the Belgian Army citation awarded the unit for distinguished service during the Ardennes Campaign. The coat of arms was authorized by the Department of the Army in 1955 and initiated by the 249th Engineer Battalion (Construction). Today the Prime Power Battalion continues the rich history of the Black Lions.

Lineage*

5 May 1943	Activated at Camp Bowie, Texas, deployed to Europe, engaged in four major World War II campaigns.
27 November 1945	Inactivated at Camp Patrick Henry, Virginia.
23 March 1948	Redesignated as the 442d Engineer Battalion, Active Reserve Corps, affiliated with the Iowa State Highway Commission.
May 1950	Inactivated and returned to Reserve status.
25 June 1952	Redesignated as the 249th Engineer Construction Battalion.
9 December 1954	Allocated to the Regular Army.
9 February 1955	Reactivated and sent to Kaiserslautern, West Germany.
20 June 1975	Redesignated as the 249th Engineer Combat Battalion (Heavy).
8 December 1990	Deployed to Southwest Asia in support of Operations Desert Shield/Desert Storm; received the Meritorious Unit Commendation.
15 October 1991	Inactivated.
18 November 1994	Reactivated as the 249th Engineer Battalion (Prime Power), Fort Belvoir, Virginia.

*From Colonel John K. Addison's *Bridge to the Past*, April 1995.

COL Addison at the dedication ceremony for the battalion conference room, July 2000

As part of "The Greatest Generation," soldiers like Addison truly have the "right stuff." When he spoke to the battalion last year during our annual Legacy Week, generational differences were put aside. Even Baby Boomers and Generation Xers were mesmerized by his words. And, at 85 years strong, he carries a presence beyond words. The stories he told about Patton—George C. Scott to you and me—captured the attention of all. His article that follows this introduction captures some of his winning spirit.

During last year's Legacy Week, we took the opportunity to recognize Addison and the numerous accomplishments of the 249th Engineer Battalion under his command, and we dedicated our battalion conference room in his honor (see photo). Units would be well served to connect their current experiences with those heroes of our past. Additionally, we recognized each unit soldier with a coin of excellence—our "rock." The rock, similar to the one carried by Addison and others, makes it easier to identify with past soldiers and serves as a foundation on which to build the future. To that end, we established a unique vision in line with our "BLACK LIONS" moniker (see vision insert on page 20) and developed a Synchronization Matrix (Action Plan) to help reach our goal. All understand that we will make history, one way or another. The rock is a symbol of TEAM members willing to work toward our vision attainment...and ensure that our history will be positive.

BLACK LIONS

...our vision

Battle-Focused — Deriving peacetime training requirements from the full spectrum of our missions.

Legacy — Linking to our past, carrying on the storied history of the Black Lions, and establishing our own proud legacy.

Army Values — Living the Army values of: Loyalty, Duty, Respect, Selfless-Service, Honor, Integrity, Personal Courage.

Caring — Genuinely caring about all Black Lions—soldiers, civilians, families.

Knowledge-Based — Becoming experts in our jobs.

Leader Development — Training leaders to live our vision/reach our end state, execute the mission, and always do the right thing…right.

Interdependence — Recognizing we're a winning team of teams that successfully operates/integrates, horizontally as well as vertically.

Organization — Striving for name recognition, establishing sound systems, and balancing requirements/capabilities that move us toward our goal.

NCOS — Living the NCO creed.

Standards — Demonstrating excellence in all we do—leader/soldier, readiness, caring standards.

Prime Power Legacy

This year's Legacy Week activities honored the history of the 249th's military occupational specialty (MOS) 52E, prime power production specialist. It also has a proud history—one that dates back to the late '50s with the inception of Army nuclear power. The SM1 reactor at Fort Belvoir, Virginia, as well as the nuclear power barge Sturgis, may be familiar to some (see article, *Engineer*, July 2001, page 2). As the military's nuclear stocks dwindled in the '80s, the MOS was absorbed by the Facilities Engineering Support Activity (FESA). The 535th Engineer Detachment, the military arm of FESA, proved vital during the Gulf War. Shortly after, in November 1994, the Prime Power Battalion stood up and is today the Army's only medium-voltage power-producing unit.

We are a U.S. Army Corps of Engineers (USACE) asset. Throw a dart at a world map and you'll most likely hit a prime power soldier on deployment. Current missions, which spread across the full spectrum of military operations, include Egypt (Exercise Bright Star), Columbia, Thailand, Soto Cano, East Timor, Kazakhstan, Joint Task Force 6 (the Department of Defense counterdrug organization), as well as support in response to the recent terrorist actions. This is in addition to the forward presence maintained daily in Korea, Germany, and Hawaii, as well as our footprint in the continental United States (Fort Belvoir, Virginia; Fort Bragg, North Carolina; and Fort Lewis, Washington). Additionally, the unit recently became a multicomponent unit with the addition of four Reserve platoons, which add another complementary capability. The mission remains to provide prime power—the bridge between tactical generators and commercial power—as well as technical assistance to commanders worldwide. In addition to two superior unit awards and one meritorious unit award, the unit has earned two Sturgis Awards, most recently in FY 2000.

Combat Heavy Legacy

The legacy of the 249th Engineer Battalion (Combat Heavy) is equally impressive. When the 249th was reorganized in the 1950s, it transitioned to more of a construction role. As part of the 18th Engineer Brigade, the 249th became well known for its expertise and commitment to excellence. Construction projects throughout Germany, most significantly the upgrading of the Grafenwohr ranges to facilitate the Abrams, Bradley, and Multiple-Launch Rocket System (MLRS) force-modernization initiatives—provided the platform for construction excellence. By winning four consecutive Itschner awards in the mid-1980s, the 249th established an unparalleled track record.

But back to Addison.... My command time with the 249th has closed, but his inspiration…his legacy serve as a reminder of selfless service and a "rock" with which the 249th continues to build its rich history. Long live the Black Lions!

Lieutenant Colonel Vesay commanded the 249th Engineer Battalion (Prime Power) at the time this article was written. He is now in the Programs, Analysis, and Evaluations Directorate in the Pentagon.

A Glimpse of History:

The 249th Engineer Combat Battalion

By Colonel John K. Addison (Retired)

I was one of those graduating Reserve Officer Training Corps seniors of the class of '41 at Oregon State who was called to service for 1 year under the provisions of a national emergency then in effect. The advent of war on 7 December changed the destiny of many of us.

In rapid succession, I was a platoon and company commander, plans and training officer (S3), and executive officer in differing engineer combat battalions, and finally—on 5 May 1943—I commanded a battalion of my own. Somehow, there was time in this 23-month period to attend the officer refresher, assault of fortified positions, and cadre training courses at Fort Belvoir, Virginia, and the 3-month wartime course at the Command and General Staff College at Fort Leavenworth, Kansas.

I was a captain when I assumed command of the newly activated 249th Engineer Combat Battalion at Camp Bowie, Texas. It was August before we could begin training in earnest, but by the spring of 1944, we had become a sharp and functioning outfit. In March, while on maneuvers in Louisiana, we were alerted for overseas shipment; and on 2 July, we were on our way in a great convoy bound for Liverpool, England. After 6 weeks at Camp Doddington—drawing and outfitting ourselves with vehicles and equipment—we crossed the channel on landing ship, tanks (LSTs). We went ashore at 0400 on Utah Beach, in Normandy, on August 19—my 29th birthday. I learned of my promotion to lieutenant colonel while at Camp Doddington.

We moved by convoy, with orders to report to the commander of the 1137th Engineer Combat Group, which was several hours inland from the beach. Although during training, we had learned to handle the battalion in convoy very well, we soon began having trouble keeping the convoy together. Long gaps were developing, so I went back in a jeep to find the problem. At a halted segment of the column, a fellow came running down the hill with a bottle of wine in his hand. He was a three-stripe sergeant and squad leader. I reduced him to private, put him in the back of the truck, and promoted his corporal assistant to sergeant. There was quite a ripple through camp that evening over the incident. I never had problems again with convoy discipline. The next morning I met my new commander, Colonel George A. Morris, who—to my great fortune—would be one of the best commanders under whom I would ever serve.

Our first major engineer project was constructing a fixed bridge across the Moselle River, near Toul, France. The concrete structure had been blown, destroying the piers, and the crossing was a key to an attack being planned by General Patton's Third Army. The work would have the highest of priorities. The site was close to the front lines on an important roadway that would become a main supply route, suggesting work of a lasting nature. The concrete slabs, which were dropped onto the streambed, were fractured and broken, but many were usable as footings for the new structure. The site was well within artillery range and mortar fire—although none came in on us during construction, for reasons that were never clear. The only infantry forward of the site were light patrols. The intelligence officer and his driver from the group headquarters went forward to reconnoiter, with a little too much ambition, and were captured or perhaps killed.

COL Addison at the Rhine-Oppenheim Crossing, March 1945

The bridge we were to build was a two-way, 193-foot span of 40-ton capacity and steel beam and wood construction. I put the entire battalion on the job initially, with one company clearing away the debris and the other two companies starting construction from each end to join at the center. I came to the site with my sleeping bag, prepared for the night. Two members of the group headquarters staff came there as well, presumably at the direction of the commander, to assure progress. After spending a few hours on the job, and after it became apparent that I would be there all night, the fellows left the job site. I did not experience that type of supervision in the future.

The artillery was booming in the distance, and the bright, clear sky was filled with artillery flashes. The work went on in blackout conditions without interruption. As the bridge was nearing competition, General Patton came to the site with his corps commander and staff. As he walked over the bridge, he waved his staff and entourage away, saying that he didn't want the whole staff wiped out with an artillery round. We finished the work well within the time specified and were pleased to later receive a letter of commendation from the XII Corps commander for our work there.

Our next major challenge was downriver on the Moselle at Pompey. Again, the bridge was critical in the plans of a Third Army attack. Because the river was split by a small island into two channels, both pile driving and post and beam construction were required for a two-way, 546-foot, 40-ton-capacity bridge. We had priority on all equipment, personnel, and materials needed for the job. I asked for an additional company of engineer troops, a platoon of a ponton company, a lighting detachment, elements of a light equipment company, and trucks (as needed) from a trucking company. We were given 12 days to complete the project.

The scope and complexity of the project called for management more in the nature of civilian work, so a project engineer was assigned. With lights available, we worked around the clock. We drove the piling with pile drivers mounted on ponton rafts. Since we were in an area of steel mills, we had no difficulty in obtaining steel I-beams and piling of most any size we needed. One dark overcast night, with all our lights on, a large British four-engine bomber came down out of the cloud cover—the pilot apparently lost and attempting to orient himself. He must have wondered about all those lights. We hoped he made it home safely. We finished the project on time, but because of major flooding on the Moselle, the attack never developed as planned. The bridge did serve a critical purpose, however, as it was one of the few functional bridges in the Army zone for some time.

It was now mid-October. The Third Army was bogged down all along the Moselle (with the gasoline supply nearly cut off) but fighting its way forward as fuel supplies allowed. By December, we were building a fixed bridge across the Saar River on the border of Germany, expecting to move on into Nazi territory at any time. But it was not to be. While we were at the bridge site, we were notified to move to the Ardennes, later to become the Battle of the Bulge.

We moved out on 20 December for Arlon, Belgium, joining the great mass of Third Army vehicles and equipment headed north. Our journey to the front from Arlon to join the 26th Infantry Division was a night I shall always remember. We were ordered to move off the main roads, without time to reconnoiter, dispatching our vehicles at 2- to 3-minute intervals—all, of course, in blackout conditions. I sent a platoon forward to post guides and hoped for good luck.

We traveled all night and arrived early next morning, with snow falling. We were to fight this snow and ice for the next 6 weeks. All of our one hundred or more vehicles and other equipment arrived without a hitch. The 26th Division was fighting desperately to hold a line at the southern hinge of the Bulge by an aggressive defense. Our mission was to prepare and man backup positions behind their lines by laying mines, felling trees, and doing anything we could to delay an enemy breakthrough. And, of course, we had road maintenance and snow removal to perform.

On 24 December, the day before Christmas, while I was in the field, I received verbal orders from the assistant division commander to relieve elements of the 4th Armored Division, which were holding two small villages—Arsdorf and Bigonville—some 5 miles to our north flank. It was early afternoon, and we were to move out at once. I gave the mission to A and C Companies, commanded by Captains Sullivan and Cissna, respectively. Sullivan was to take over Bigonville and Cissna the village of Arsdorf.

Sullivan moved into Bigonville without difficulty, taking some 30 prisoners in the process. Cissna ran into trouble, finding that Arsdorf had never been taken by the 4th Armored and was still in the hands of the enemy. The company fought its way in, having no other instructions. It never occurred to me that the information given me would be faulty. Captain Cissna was killed while manning a machine gun and was awarded the Distinguished Service Cross, posthumously, for his heroic actions. Twenty-seven of our men were captured, with 23 being recaptured a few days later. The three others spent the remainder of the war as prisoners.

Following this infantry mission, B Company, then commanded by Captain Berman, was detached from the battalion for several weeks and assigned to Task Force Fickett, a reinforced armored cavalry group, protecting the south flank of the Third Army. They became, in effect, the point of the armored group performing mine clearance and snow removal. The fellows jokingly claimed the distinction of being the point of the whole Third Army.

We continued our support of the 26th Division, which was fighting its way northeast, performing all kinds of engineer work until final closure of the Bulge.

Our last challenge of the Bulge Campaign was a bridge over the Our (Uhr, in German text) River, smack up against the Siegfried Line. This was in the vicinity of Dasburg and coursed along the far hillside of the Our River canyon, with pillboxes and concrete emplacements readily visible from the so-called Skyline Drive atop the high ground on the near side of the deep Our River canyon. We learned early on that we would be building a Bailey bridge across the Our at Dasburg. The site was at the bottom of the canyon, clearly visible by the enemy and in line of sight of many of the pillboxes. The attack on the line would be by surprise, with no artillery or bombing preparation. The near side of the canyon was covered with a heavy growth of 12- to 20-inch timber, with a winding, steep one-way earth road to the bridge site. Although the snow had mostly melted in the open, the road was covered with a thick coat of snow and ice. The trucks carrying the bridge equipment had to move in blackout conditions over this road to the bridge site. I discussed all this with the division engineer, pointing out the line-of-sight enemy coverage of the bridge site and showing them line-of-sight profiles, but his response was only a shrug of the shoulders.

The Bailey was to be a 120-foot double-double, meaning a bridge of two panel widths and two in height. We moved to the bridge site early the night of 21 February. I went with the column of trucks to the site, with the bridge panels rattling and banging and the ice crunching and breaking as we came down the steep grade into the canyon. Not a shot was fired nor did a round of fire come onto the site as the work progressed throughout the night. At daybreak, six German soldiers came out of a pillbox directly above the far bridge abutment with their hands in the air, carrying white handkerchiefs. The German army had pulled back from the line and had left their old and young men to man the defenses. They had little or no fight left in them. The 6th Armored Division broke through the line without great difficulty, and the Third Army moved slowly but steadily east into Germany.

By mid-March, the battalion was at Adenau when the Third Army began the breakthrough to the Rhine. We were soon told that we would be a part of an engineer task force for the assault crossing of the Rhine. The 1135th Engineer Combat Group would actually comprise the task force but was filled with specially selected units for the crossing.

How was it that we became a part of the task force? Back in October 1944, Colonel Morris had brought Colonel Alfred Starbird, an engineer with General Patton's headquarters, to the battalion to discuss our operations. I had no idea why he was there, but we spent a couple of hours talking. Later, I learned that he was there to select units for the task force he was planning. The planning for this operation was done far in advance since no one knew when it might come about—perhaps very suddenly. All of our companies were sent back to the rear that fall to practice such things as motorboat operations, rafting, and handling of assault boats. We never knew if we would indeed be a part of the assault operation until it came about.

I was on leave in London for 5 days when orders finally came. When I returned on 21 March (after transportation delays), the battalion was already at Oppenheim and was prepared to cross the next morning. The site of the crossing was at Nierstein, to some, but was at Oppenheim in Patton's own history. Colonel Starbird was there to command the operation. There would be no artillery or bombing preparation for the attack.

The 249th manned the assault boats for the second wave of infantry in the early morning darkness. Construction of rafts carrying troops and light equipment followed very shortly. Construction of the heavy ponton bridge started as soon as, and almost concurrently with, the rafting operations. Opposition was light, but artillery and fighter-bombers were soon coming in. The heavy ponton bridge was of 40-ton capacity and 1,134 feet in length. The assault, which was launched secretly, was a real success and close to a textbook exercise.

I went across on one of the motorboats and found a dead German officer in full dress uniform not far from the bank. The operation was an obvious surprise to him. Large numbers of prisoners were taken within hours after beginning the crossing. On return trips, our rafts were loaded with prisoners. In one case, a raft capsized with some 250 men aboard. For some reason, the prisoners bolted—perhaps from a nearby artillery round—pushing to one side of the raft and sinking it. About 25 prisoners were saved, but one of our men was lost.

COL Addison at Camp Lucky Strike, near Marseille, heading for home.

A week later, we moved downstream for another crossing at Mainz. The assault would be made early in the morning but in daylight. We operated the assault boats, built and manned the rafts, and finally constructed the 1,810-foot floating Bailey bridge. The bridge was new to us and tough to handle with the heavy Bailey panels. As there was no element of surprise here, there was more enemy resistance with small-arms fire and more artillery and air action.

Colonel Don G. Elliget, our new commander, came to the project in early March, shortly after its completion. He told me that the 249th was being taken from his command and assigned directly to the Third Army headquarters. Our mission would be to secure, maintain, and remove—as ordered—the 11 bridges in the zone of the Third Army.

At the end of the war in Europe, on 8 May, we had orders to move to Plattling, Germany, near the Czech border, where we would build a displaced-persons camp to house the thousands of refugees streaming in from the East. We would have 5,000 prisoners of war assigned as laborers. In mid-October, the 249th had orders to ship to the United States, and the battalion was deactivated on 28 November 1945.

The 249th Engineer Combat Battalion earned battle streamers for campaigns in Northern France, Rhineland, Ardennes-Alsace, and Central Europe. Following the war, the 249th—along with the 26th Infantry Division—was cited by the Belgian government for its actions in clearing Belgium of the Nazi menace. The 249th's coat of arms was derived from that Belgian citation.

Now in my 86th year—and having spent a career in the Corps of Engineers, United States Army, followed by another career in the engineering field—nothing has given me the satisfaction and pride I derived from the wartime experience of commanding that fine bunch of officers and men making up the 249th Engineer Combat Battalion.

Engineer Battalion Mobility/Survivability Rehearsals

By Lieutenant Colonel Thomas H. Magness

Observations at the National Training Center (NTC) continually reinforce the added value of rehearsals at every echelon. Engineers regularly benefit from rehearsing battle drills at the crew, squad, platoon, and company levels, as well as integrated maneuver-level rehearsals. The importance of rehearsals at the task-force and brigade-combat-team (BCT) levels is paramount; both synchronize across the width and depth of the battlespace, especially for detailed operations such as combined-arms breaching or forward passage of lines. Successful units rehearse everything, including fire support and combat service support (CSS).

The purpose of this article is to make a case for mobility/survivability (M/S) rehearsals at the engineer-battalion/BCT level. Specifically, the article will address rehearsals in doctrine and among other members of the combined-arms team; highlight the need for engineer rehearsals; and suggest a framework—specific issues, timing, and participants—for the rehearsals.

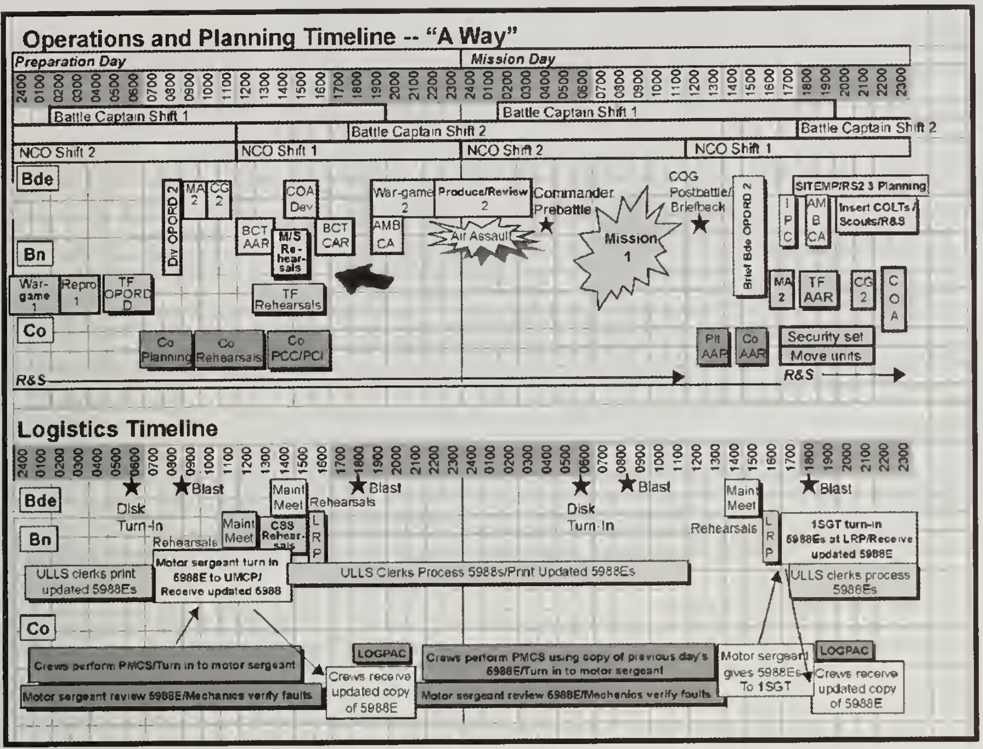
Doctrine

As important as the fire-support rehearsal is to integrating the fire-support Battlefield Operating System (BOS) into the tactical operations, the M/S rehearsal is no less critical. This is especially true in the offense, where synchronization can generally be achieved only by thorough, detailed rehearsals. Some potential issues that we need to rehearse include (but are certainly not limited to)—

- Decision points affecting engineer task organization.
- Commitment of mobility reserves.
- Execution of situational obstacles.
- Decisions tied to BCT-level decision points.
- Transition to the defense.
- Engineer CSS (such as resupply operations for the mine-clearing line charge [MICLIC] and casualty evacuation [CASEVAC]).

A similar menu of possible issues can be defined for defensive operations. Admittedly, these actions to be rehearsed will often involve engineers who are not under the command of the engineer battalion (for example, companies that are under the operational control of or that provide direct support to maneuver units). This is a challenge similar to the one faced by the fire-support coordinator (FSCOORD), who must synchronize all the components of his BOS (to include close air support, direct support, and reinforcing fires and mortars)—many of which he does not command. The dual-hatted nature

Engineers conduct a sand-table rehearsal at NTC.


Operations and Planning Timeline -- "A Way"
Preparation Day
Mission Day
Battle Captain Shift 1
Battle Captain Shift 2
NCO Shift 2
NCO Shift 1
Bde
Bn
Co
Div OPORD 2
MA 2
CG 2
COA Dev
BCT AAR
M/S Re-hear-sals
BCT CAR
War-game 2
Produce/Review 2
AMB CA
Air Assault
Commander Prebattle
Mission 1
COG Postbattle/ Briefback
Brief Bde OPORD 2
IPC
AMB CA
SITEMP/RS2 3 Planning
Insert COLTs/ Scouts/R&S
War-game 1
Repro 1
TF OPORD
TF Rehearsals
MA 2
TF AAR
CG 2
COA
Co Planning
Co Rehearsals
Co PCC/PCI
Plt AAR
Co AAR
Security set
Move units
R&S
Logistics Timeline
Blast
Disk Turn-In
Maint Meet
Rehearsals
CSS Rehear-sals
LRP
1SGT turn-in 5988Es at LRP/Receive updated 5988E
ULLS clerks print updated 5988Es
Motor sergeant turn in 5988E to UMCP/ Receive updated 5988
ULLS Clerks Process 5988s/Print Updated 5988Es
ULLS clerks process 5988Es
Crews perform PMCS/Turn in to motor sergeant
Motor sergeant review 5988E/Mechanics verify faults
LOGPAC
Crews receive updated copy of 5988E
Crews perform PMCS using copy of previous day's 5988E/Turn in to motor sergeant
Motor sergeant review 5988E/Mechanics verify faults
Motor sergeant gives 5988Es To 1SGT

Legend:

AMB - air mission brief
CG - commander's guidance
COG - commander-operations group
COLT - combat observation lazing team
IPC - initial planning conference
LOGPAC - logistical package
LRP - logistical resupply point
MA - mission analysis
PCC/PCI - precombat checks/precombat inspections
PMCS - preventative maintenance checks and services
SITEMP - situation template
ULLS - Unit-Level Logistics System
UMCP - unit maintenance collection point

of his position (direct-support battalion commander/brigade staff officer-FSCOORD) is no different from that of the engineer commander (battalion commander/brigade engineer). Our challenge is not in deciding *IF* we should synchronize combat-engineer operations across the width and depth of the battlespace—it is *HOW*!

Training Circular (TC) 25-10, *A Leader's Guide to Lane Training*, indicates that rehearsals are "training techniques to ensure that team members understand what they and other members of the team must accomplish to perform a task successfully." Furthermore, rehearsals are "one of the techniques used by the commander to achieve synchronization both in military operations and in training." Combat engineers are generally successful at rehearsing engineer drills and, to a lesser extent, in integrating these drills into combined-arms operations. Where we often fail to rehearse—and achieve the appropriate degree of synchronization—is with the other (engineer) team members (engineer peer leaders, Reserve engineers, and our own engineer CSS). The result is that engineers often struggle with identifying key decision points, make "on-the-fly" tactical decisions, do not leverage the full capabilities of engineer units, and fail to fully integrate our BOS within the higher-level maneuver scheme.

Need

Some generalized observations from the NTC that highlight the challenge are as follows: The engineer battalion issues the M/S requirements to subordinate units through two primary mechanisms—the BCT operations order (OPORD) and the engineer battalion OPORD. Field Manual (FM) 5-71-3, *Brigade Engineer Combat Operations,* articulates the specific issues and requirements of each. These, however, are top-down requirements documents. The nature of the (engineer battalion) parallel-planning process and the degree of refinement that follows OPORD issue (at engineer battalion and subordinate unit levels) highlight the need to reassemble, capture the bottom-up refinement of subordinate-unit plans, and synchronize combat-engineer operations. The failure to synchronize the BOS through detailed rehearsals generally results in the engineer being a "nonplayer" at the combined-arms rehearsals (CARs) and, in execution, translates to difficult, if not impossible, integrated action. We've all seen it—let's fix it!

Framework

The discussion below is an attempt to outline a framework for M/S rehearsals. The bottom line, however, is that the commander must apply mission, enemy, terrain, troops, and time available (METT-T)—especially *time*!—to determine the best way. But again, this is not an *IF*—but a *HOW*!

Who? – The engineer battalion commander should certainly be able to count on the participation of those whom he commands—the headquarters and headquarters company commander, support-platoon leader, combat-support-equipment platoon leader, mobility Reserve leader (if applicable), plus key battalion leaders—the S1/S4, S2, S3, command sergeant major, and executive officer. Obviously, the key players are the subordinate units whose actions must be synchronized. What is the baseline requirement? Consider as appropriate any leader who can articulate the maneuver-level plan and the engineer support to it. This could be the subordinate (company) commander, executive officer, or assault and obstacle platoon leader. Basically, it is any engineer leader who can articulate

Map, sand-table, terrain-model, rock-drill, or radio (FM) rehearsals are all valid techniques.

the location and disposition of engineers in the maneuver formation, task-force decision points, condition setting for breaching operations, and the task-force situational-obstacle plan.

When? – FM 71-123, *Tactics and Techniques for Combined Arms Heavy Forces: Armored Brigade, Battalion Task/Force, and Company/Team*, indicates that "rehearsals must be executed at the right time and in the right sequence to maximize their potential value." Ideally, subordinate engineer units "should have developed at least a tentative plan before they participate in a rehearsal of their higher-headquarters operations." Without a tentative plan from subordinate engineer leaders, "feedback on the higher-headquarters plan is very limited, and the actions rehearsed may not resemble the final plan of the subordinate unit."

In general, the M/S rehearsal should be after the task force CAR and before the BCT CAR to be of value (see table on page 26). For comparison's sake, the fire-support rehearsal is often 1 to 2 hours before the BCT CAR. Additionally, the staff and the mobility reserve (for example, those who work directly for the engineer battalion) should have conducted internal rehearsals before the M/S rehearsal. An article titled "Command and Control: Seeing the Battlefield," *Engineer*, February 1998, identified some decision-making tools for engineer commanders. This article highlights some examples of staff-generated products that should be produced and synchronized for the commander before the rehearsal. They may form the basis for what must be rehearsed.

Where? – Consider the battalion tactical command post (TAC) or some centrally located command post. The TAC is often ideal since we have great talent available to construct the terrain model or other similar rehearsal tools. It could also be conducted on the hood of a high-mobility, multipurpose wheeled vehicle (HMMWV) (map rehearsal) but should minimize the travel time for subordinates as well as the commander—who likely must get his own act together before his own higher-level rehearsal (the BCT CAR).

What? – FM 71-123, TC 25-10, and other references all comment on various tactics, techniques, and procedures (TTP) for rehearsals. All are valid techniques and are based on the time available, the attendees, and what is being rehearsed. The various techniques may include maps, sand-table or terrain models, rock drills, FM radios, or tactical exercises without troops (TEWTs). Each implies a different degree of time and resources.

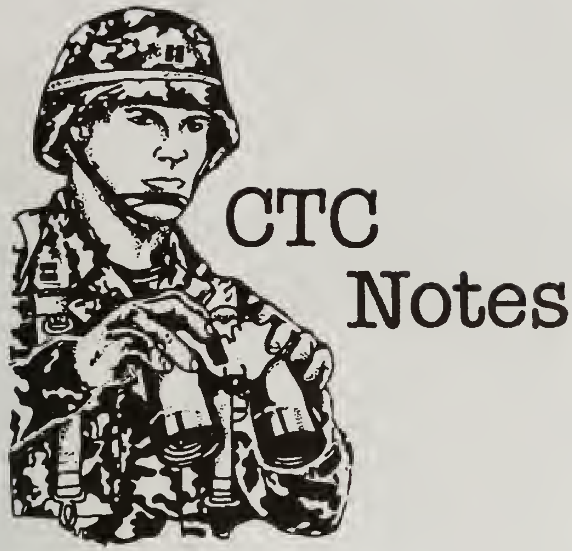
Why? – TC 25-10 indicates the following benefits for rehearsals (parenthetical comments are added for the engineer BOS):

- Rehearsals ensure that personnel know—
    - What the commander intends to accomplish (engineer commander's intent).
    - How he intends to accomplish it (concept of operation/scheme of engineer operations).
- Rehearsals enable synchronization by—
    - Verifying specific responsibilities (situational obstacles, CSS, and obstacle breaching).
    - Coordinating timing of actions (engineer decision points and transition to the defense).
    - Confirming backup procedures.
- Rehearsals enhance battlefield success (enough said!).

FM 71-123 gives several examples of how to conduct rehearsals. A framework for M/S rehearsals may include the following:

- The S2 sets the conditions of the battlespace by discussing the enemy courses of action (COAs) and highlighting enemy engineers, obstacles, key terrain, and "shapers." It would also be appropriate to review the BCT reconnaissance and surveillance (R&S) plan to focus the engineer participants on obstacle-intelligence collectors, named areas of interest, and observers that trigger key engineer actions.

(Continued on page 38)



Battle Command Training Program

Reporting and Disseminating Relevant Engineer Information

By Lieutenant Colonel Scott Bickell

Each year, the Battle Command Training Program (BCTP) consolidates significant lessons learned as a result of the Warfighter exercises. Developed for each Battlefield Operating System (BOS), these lessons learned become BCTP Perceptions, once approved. This article focuses on one Engineer Perception for FY 01 and lists some tactics, techniques, and procedures (TTP).

Perception: Units must adequately report and disseminate engineer information.

Discussion: During the past several division and corps Warfighter exercises, units have not adequately reported and disseminated relevant engineer information such as locations of obstacles and breach lanes and the status of main supply routes (MSRs). As a result, we have observed numerous incidents of fratricide in our obstacles, logistics convoys trapped in known enemy obstacles with breach lanes, and units having to breach obstacles that were known but not reported or disseminated. With all of the "common-operating-picture" tools that we possess, how can this be?

- All units that we have observed during Warfighter exercises possess some type of digital system for reporting and disseminating information and maintaining a common operating picture. These systems are either from the Army Tactical Command and Control System suite—such as the Maneuver Control System (MCS) and the All-Source Analysis System—or an off-the-shelf e-mail system. While these systems are good tools for reporting, consolidating, and disseminating information, "message sent" does not equal "message received, opened, and used." Figure 1 reflects that this division was reporting and disseminating enemy obstacle information, to include known and templated obstacles. All of the command posts (CPs) listed in the left column had this information on their systems, but several were not aware that it was there. Therefore, they did not post this relevant information on their maps and overlays. All but one of these CPs had a copy of the original enemy obstacle template posted, but it was not updated with current information.

Enemy Obstacles and Breaches	
CP	Overlay
DMAIN	Posted and updated in Engr Bde
DTAC	Posted; obstacles not updated
DREAR	Posted; not updated
1BDE	Posted and updated
2BDE	Posted; not updated
BDE	Posted; not updated
CAV	Posted and updated
FA BDE	Posted; not updated
DIVARTY	Not posted or updated

Figure 1. Common Engineer Picture

- For units that do not have digital systems, we observed the same issues with disseminating information. These units rely on hard-copy overlays and reports for gathering and disseminating information. Typically, engineer units will produce obstacle overlays for friendly and enemy obstacles (to include templates) and disseminating these to major subordinate command CPs. The problem arises when new obstacles are emplaced or reported other than what is already on the overlay. This information is rarely disseminated throughout the force.
- Another issue we have identified is the echelon above division/corps units that are supporting the division/corps are often left out of the information loop. Sometimes these units will not have the digital system that the corps or division is using and will rely on analog overlays and reports. Many corps artillery units and corps support command (COSCOM) convoys have suffered fratricide in our obstacles because they were unaware of the location of these obstacles. Figure 2, page 28, shows the impact of units not having a "common obstacle picture." The unit in the figure was transitioning from the defense to the attack. The brigades did not have a common picture of where the obstacles were emplaced in the division sector—in other words, a division obstacle overlay. As a result, the division had to breach its own obstacles, and it lost a battalion task force of combat vehicles in obstacles that it emplaced.

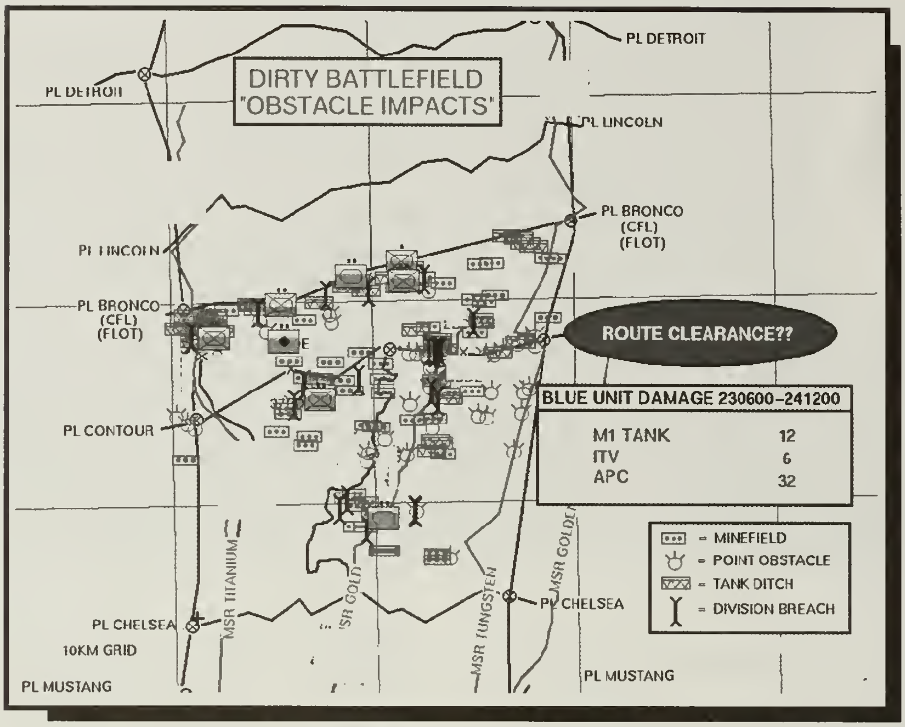


Figure 2. Dirty Battlefield "Obstacle Impacts"

- The lack of adequate and accurate obstacle breach reporting and disseminating of this information is another issue. Do we need to report every breach lane to the division or corps? The unit SOP should address this issue, but we should, at a minimum, report those breaches that we conduct on MSRs, alternate supply routes (ASRs), and other routes such as cross-mobility corridors. Figure 3 shows that the unit conducted 40 breaches of enemy obstacles and reported only nine to the division. Many of the breaches that the unit did not report were along the MSRs. Also, the unit did not report many of the obstacles that were breached.

- Figure 4 depicts the cause and effect of the lack of reporting and disseminating obstacle and breach information. The convoy symbols show three logistics convoys that became trapped in enemy obstacles, which were on MSRs, that had been breached and not reported. Because they were not reported, the division transportation

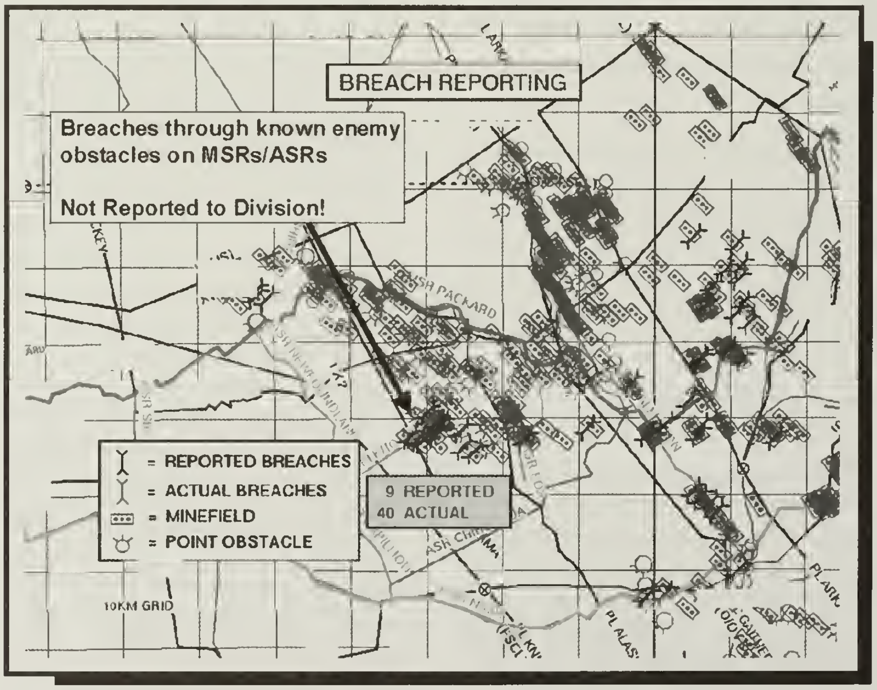


Figure 3. Breach Reporting

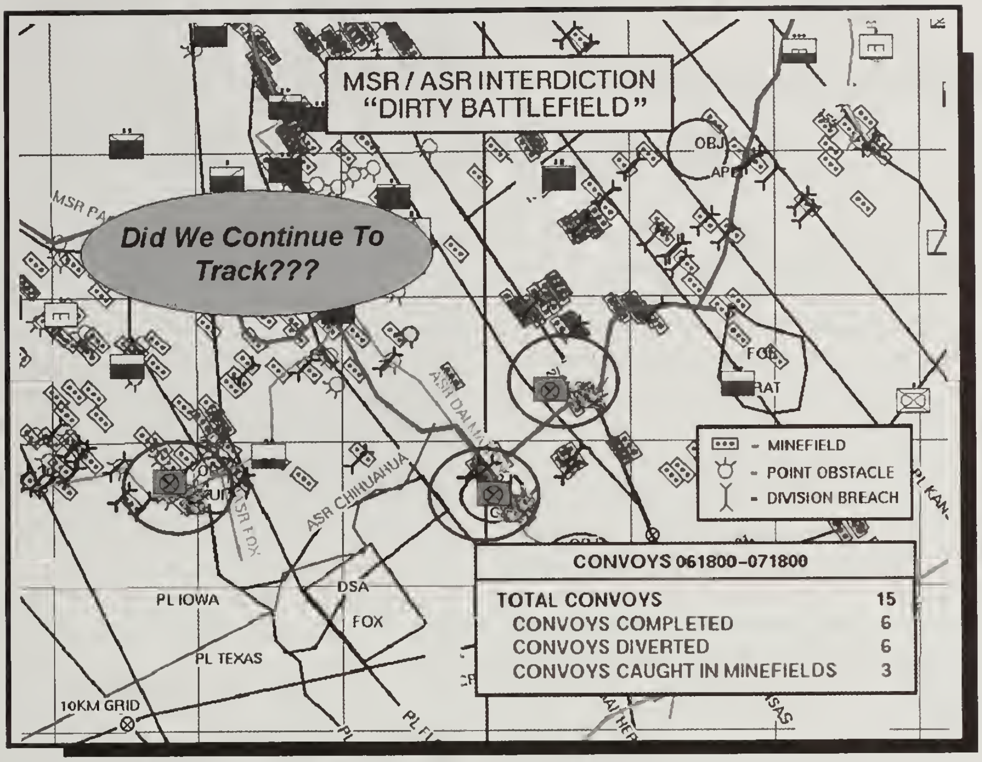


Figure 4. MSR/ASR Interdiction "Dirty Battlefield"

officer had designated the status of the MSR as "Green" and continued to send convoys up these MSRs.

So, how can we fix this problem of not reporting and disseminating relevant engineer information? The cause of many of these issues lies in unit SOPs. Some units do not follow their SOP for reporting and disseminating information; others have a cumbersome system that makes accurate and adequate reporting difficult.

TTP:

- Conduct a review of unit SOPs and streamline the reporting process. Determine what information is actually needed for reporting obstacles and breaches.
- Ensure that your SOP includes reporting and disseminating information using digital systems for units that have them. Also include how you will receive reports from and disseminate information to supporting units that do not have digital systems.
- Develop a systematic process for reporting and disseminating relevant engineer information throughout the force using digital and/or analog systems. Include this process in your SOP and the division/corps SOP.
- Follow up with a call on the radio, mobile-subscriber equipment, or nonsecure digital voice terminal to the units that you disseminated engineer information to using digital systems. Tell them where the information is, and then get a confirmation that they received it.
- Ensure that you include echelon above division/corps units in your distribution. It is easy to forget the reinforcing artillery brigade, Patriot units, and COSCOM.
- Ensure that you have a tracking chart/matrix or some other mechanism that can provide a roll-up of all obstacle reports and breach-lane locations. This can be disseminated to units using digital systems and/or tactical facsimile. Again, follow up with a voice transmission after you have disseminated the information.

Lieutenant Colonel Bickell is the mobility/survivability BOS chief for BCTP Operations Group Bravo at Fort Leavenworth, Kansas. Before this assignment, he served as the assistant division engineer, 4th Infantry Division, and S3, 588th Engineer Battalion, 4th Infantry Division. LTC Bickell has also served in various command and staff positions in divisional and corps combat engineer battalions.

DEMINING OMAN:
THIRD U.S. ARMY SOLDIERS HELP MAKE THE NATION SAFER

By Staff Sergeant Jeff Troth

Most U.S. citizens go through their entire life without having to worry about encountering a land mine. For some countries in the middle of a war, land mines are an everyday occurrence. Still other countries have not had a war in years, yet land mines buried decades ago still pose a hazard to their citizens.

The middle-eastern country of Oman falls in this last category. Although the majority of its citizens have never encountered a land mine, parts of the country are scattered with minefields from past skirmishes. Unfortunately, neither side recorded most of these minefield locations. But the land mines of serious concern are the recorded minefields that have shifted positions because of heavy rains in the region. The handwritten records have faded, making it even more difficult to locate these minefields.

Oman has a low-to-moderate land mine/unexploded-ordnance problem. From 1964 to1975, antitank and antipersonnel land mines were laid in the Dhofar region, in the southwestern part of the country, during an internal struggle with the People's Front for the Liberation of Oman (a communist separatist group).

An Omani deminer gets suited up before a practical exercise on lane-clearing techniques.

In 1984, the Royal Army of Oman (RAO) established a 60-man Mine Clearance Troop to conduct demining operations. Currently, the troop is demining known battlefields and areas where land mine incidents have occurred.

To help alleviate the land mine problem in Oman, a 25-man humanitarian demining team from the Third U.S. Army/U.S. Army Central Command (ARCENT), Fort McPherson, Georgia, went to Oman this year to train the RAO engineer soldiers on international demining tactics and techniques. The team's goal was to assist in reclaiming the minefields for civilian use. The 90-day training was divided into three main areas: demining, information management, and mine awareness.

Demining

By regulation, U.S. soldiers do not go into a country for humanitarian demining and start clearing minefields. Instead, they train that country's engineers to international demining standards—in other words, train the trainer. Then, the U.S. soldiers become assistant trainers, and the soldiers they have trained, in turn, train their fellow soldiers.

According to one Omani engineer, who had 3 years of training with the RAO combat engineers before his training with the U.S. demining team, the RAO operation is basically the same as the U.S. soldiers taught. But he said that the biggest difference was the safety consideration, because U.S. training gives a higher priority to the safety aspect of demining. Within the minefield, safety standards are similar, but the international standard calls for safety before entering the minefield. Soldiers are taught not only to mark the boundary of the minefield but also to mark a safe zone around the minefield for demining operations.

The training the U.S. soldiers brought to these engineer soldiers included methods for determining the size of a minefield and calculating the time it would take to clear a minefield. Learning the necessary formulas was difficult unless a soldier had a background in geometry, but with practice it became easier.

Adding to the difficulty of learning the new calculations and demining techniques was the language barrier. Although some of the RAO soldiers have an understanding of the English language, few of them speak or read it fluently, so having a good translator was essential. However, the translators were not the only place the instructors got help with teaching the RAO soldiers; the students also helped each other. They wanted to make sure that everyone in the class understood what was being taught. They knew that one day, they would

A U.S. soldier shows Omani soldiers how to calculate the area of a minefield.

be doing this for real, and their life could depend on their classmates getting it right.

Besides the classroom work, the Omani deminers received hands-on training in the field, where U.S. soldiers set up simulated minefields, complete with practice land mines. Here RAO soldiers were taught how to prepare an area for demining, as well as procedures for safe demining, which included using 25-pound blast suits and a variety of metal detectors.

Information Management

Humanitarian demining information management is the collection of all data for minefields, suspected minefields, and unexploded-ordnance sites where there have been incidents. The U.S. soldiers taught the Omani soldiers to store raw collected data and analyze it on a computer. This information included minefield location and size, demographics, and whether or not the minefield had shifted from a previously known site.

Soldiers in most Third World countries don't have computers at work, and the ones who do are usually high-ranking officers. So before the U.S. demining team arrived in Oman, computers were purchased from a local vendor (with U.S. Department of State funds), and the RAO soldiers attended a computer course to learn the basics. Once the training was completed, the equipment was donated to the country for use in demining. Omani soldiers in the Information Management Section believe that they will benefit greatly from having computers. Before they had computers, minefield information was on large (paper) files. Now everything is on one disk, so the information will be easier to manage.

The Information Management Section provides reports to the RAO and U.S. Army Corps of Engineers commanders that indicate where the demining teams are, what they are doing, and how they are progressing. As the central system—the brain of the whole operation—the Information Management Section keeps track of the actual demining areas and maintains a command and control network over the other demining sections.

Mine Awarenes

While the majority of the training the U.S. soldiers provided built on the RAO deminers' current tasks, the Omanis were shown a new way to protect their fellow countrymen from land mines—mine awareness. Mine awareness is considered to be advertising—telling someone to do something or not to do something. Soldiers from the 8th Psychological Operations Battalion, Fort Bragg, North Carolina, are the first wave and show up at a mine-clearing site before the deminers. According to one soldier from the battalion, the demining students thought that letting the Omani people know about mines and minefields would be an easy task, but they quickly learned it wasn't that simple.

Before developing products and getting the word out, the mine-awareness team analyzed its target audience to determine how the people received their news. Since the majority of the Dhofar region is a vast rocky desert, which is used by nomads for grazing livestock (goats, cattle, and camels), it was pointless to make TV commercials telling that a demining operation was going to take place there. But even if they don't read, or don't have radios or TVs, there is still some way that they get news. It may be the town sultan, who tells them about world events every day at prayer time. But you must know their media source to develop a product.

The point of knowing their target audience was driven home when the U.S. team showed the RAO soldiers mine-awareness products from other countries. One product had a picture of someone holding a land mine, but it was overprinted with a red circle with a diagonal line through it. Although most Americans and several other nationalities know this means not to touch land mines, it meant nothing to the Omanis. Their symbol for "no" uses the red circle, but they place an "X" inside it.

The class determined that for a mine-clearing scenario near a playground, using soccer balls and T-shirts with mine-awareness messages on them was a good way to educate the kids about the dangers of mines and what to do if they found one.

Conclusion

One Omani soldier in the mine-awareness class had been a field engineer tasked with putting up and clearing minefields. Before the U.S. soldiers came, his job was just related to the military, but now it combined military with civilian. He said that his people know about mines and that they are dangerous, but it isn't really a topic that is talked about. The mine-awareness class showed him how to get the word out. With this training, he not only can serve his country better—but also his people.

Staff Sergeant Troth was assigned to the Third U.S. Army/ARCENT Public Affairs Office, Fort McPherson, Georgia, when he wrote this article.

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Enemy Geospatial Engineers: We Are Not Alone

By Captain Amy Wallace

The views expressed herein are solely those of the author. No endorsement by the U.S. Government or its agencies or subparts, including the Department of Defense and the Department of the Army, is intended and none should be implied.

As the United States entered into Desert Shield in 1991, the armed forces faced a serious problem. All existing maps of the Persian Gulf were old and outdated.[1] To correct the problem in a time-efficient manner, the Department of Defense turned to Satellite Probatoire d'Observation de la Terre (SPOT) Image, a commercial satellite imagery company in France. With 20-meter multispectral images of the area, commanders and planners could identify urban areas, roads, and other features on the ground, as well as begin planning for the coalition forces' airfields, logistical bases, drop zones, or whatever else they would need for operational success. With an unprecedented knowledge of the battlefield, coupled with overwhelming offensive power, the complete success of the Gulf War marked a vast turning point in how future battles would be fought.[2] At that time, did anyone realize that warfare had hit a turning point? The success of the United States in the Persian Gulf demonstrated how valuable commercial space technology could be in military operations, and the market has been booming ever since.

The Imagery Market

At the time of the Gulf War, SPOT Image was one of a very few companies that provided satellite imagery on the commercial market. Today, there are half a dozen such companies in the United States alone. Three companies—Orbital Science Corps, EarthWatch, and Israel's West Indies Space—are expected to launch satellites that can collect less-than-1-meter resolution imagery this year. It is projected that by the year 2010, ten nations will have their own imagery systems—many with the ability to collect at 1-meter or better resolution.[3]

In his 1998 paper titled "Commercial Satellites: Future Threats or Allies?" U. S. Navy Lieutenant Commander J. Todd Black observed that commercial satellite companies "are rapidly driving their systems to 1-meter resolution, but the reason they need such fine resolution is unclear. ... Do large-scale observations of areas for environmental study need to define individual trees to be useful? Urban planning might benefit from detailed photos, but it would be far more cost-effective to use conventional aerial methods to obtain them. Given the expense involved, there are only two reasons to insist on high-resolution satellite photos: first, when a person does not have access to the target area, and second, to obtain information without the knowledge of the area's owners." Whatever the reason, demand for this quality imagery exists on a large scale.

Major Imagery Vendors

There are five major commercial imagery vendors, differing mostly in data collection methods and in raw-data processing techniques, although the products offered by each are similar:

SPOT Image, the brainchild of the French Space Agency (Centre National d'Etudes Spatiales [CNES])—in cooperation with Sweden and Belgium—was the first commercial company to market satellite-derived geographic information to the world market. The company currently operates four satellites, offering the same resolution today as it did during the Gulf War in the 1990s. All four satellites have 20-meter multispectral imaging (MSI) and 10-meter panchromatic (pan) resolution. The fourth satellite offers a little more in terms of vegetative monitoring systems but, for the most part, the company's current satellites are very similar to each other.

SPOT Image will launch its next satellite, SPOT 5, in April 2002. New technology will produce 2.5-meter and 5-meter imagery in scenes that cover 120 by 120 kilometers. An additional dedicated sensor set will produce stereo-imagery, from which digital elevation models of any location on earth will be produced. The SPOT constellation can get repeat coverage of any location every day for disaster monitoring and other rapid response applications.

Space Imaging is the current operator of the land remote-sensing satellite (LANDSAT)-series, which was previously operated by the government. The LANDSAT program was commercialized in the 1980s and, to date, the only operational systems are LANDSAT 6 and 7. These systems, which offer imagery qualities of 25-meter MSI and 15-meter pan, have been widely used in land cover monitoring and assessment, as well as mapping large areas.

Space Imaging has also been operating its own satellite—IKONOS—since 1999. This system offers markedly higher resolution than the LANDSAT systems, with 4-meter MSI and 1-meter pan. The IKONOS revisits locations on the earth's surface every 1 to 3 days, depending on the quality of resolution.

Delivery times for Space Imaging products vary from several hours to 5 days, depending on the products requested and the availability of raw data. Product prices range from $30 to $300 per square mile for North American commercial sales and run roughly twice that for international sales.

Orbital Imaging Corporation (OrbImage) is working toward a digital system of five satellites. The company currently operates two satellites: OrbView 1, launched in 1995 as an atmospheric imaging system, and OrbView 2, a land and oceanic imaging system launched in 1997. OrbView 3 and 4 are scheduled to be launched this year. The new satellites will offer 4-meter MSI and 1-meter pan resolution, moving OrbImage closer to its goal of creating highly precise digital maps and three-dimensional fly-through scenes. OrbImage also holds exclusive rights to distribute imagery from the Canadian-built RADARSAT 2 satellite, to be launched in 2003, which will be the fifth satellite in the Orb quintet.

Aerial Images, Incorporated, in a consortium between two American-based companies and the Russian Interbranch Association SOVINFORMSPUTNIK, markets 1- and 2-meter resolution images and image-based products worldwide. Aerial Images is also home to TerraServer, an Internet-based satellite imagery "gazetteer" that is free to download on any personal computer.

EarthWatch, Incorporated, is the first commercial company in line to break the 1-meter-resolution threshold. Earlier this year, EarthWatch was granted a license to operate a less-than-1-meter-resolution satellite, which is under construction. QuickBird 2, scheduled for launching later this year, will offer 3-meter MSI and 0.61-meter pan resolution for worldwide distribution. This will be the first satellite in orbit operated by EarthWatch, following two failed attempts. However, the company already provides imagery and imagery-derived products from other sources that can be viewed or purchased online.

Table 1 shows a comparison of the five major commercial imagery vendors.

Company	SPOT Image	Space Imaging		OrbImage	Aerial Images	EarthWatch**
Satellite	SPOT 1, 2, 3, 4	LANDSAT	IKONOS	OrbView 2	SPIN-2	
Resolution	20 MSI, 10 pan	25 MSI, 15 pan	4 MSI, 1 pan	1,000 MSI	1-2 pan	
Resolution, Next Generation	10/20 MSI, 2.5/5 pan			4 MSI, 1 pan		4 MSI, 1 pan
Cost	$0.09-$3.50 sq km	$.14-$1/sq km	$12-$34/sq km	$500/ 1,500 x 2,800 km	$25-35/sq km	$495-$695/sq km
Revisit	1 day	16-18 days	1-3 days	1 day	8-15 days	
Ordering	Average	Easy		Difficult	Average	Average
Minimum Order Requirement		X			X	
Delivery	1-5 days	1-5 days		2 days	15 days	2 days
Payment						
Check	X	X				X
Money Order	X	X				X
Credit Cards	X	X			X	X
Other	Account					
Restrictions		*		*	*	*
Ordering ease is an opinion based on the author's experience.						
*Federal law prohibits U. S. companies from selling products to Cuba, Iran, Iraq, Libya, North Korea, Pakistan, Sudan, Serbia, and the Federal Republic of Yugoslavia.						
**EarthWatch does not currently operate any of its own satellites but sells imagery collected by other companies.						

Table 1. Comparison of Commercial Imagery Vendors

A digital image of southern Iran shows geological features, drainage patterns, and vegetation (Indian Remote Sensing Satellite).

Using the Products

Because of the similarities of the imagery products themselves, and the exponentially growing demand, most of the products are processed into a form that makes them easy to use. An Internet search will provide some online images with free downloadable viewers. Although these products are mostly archived images of metropolitan areas, they provide an idea of where this field is heading. Most commercial vendors market their products in photographic form or in the form of computer-compatible tapes and CD-ROMs. Most products can be read and manipulated using common raster conversion software, available as a "stand-alone" product that can be installed on any newer computer with a Windows 95 or higher operating system.

The price range for raster conversion software is about $1,200 to $4,000, and many software companies offer training courses for an additional fee. Other training can be received by enrolling in 2- to 5-day "crash courses" offered by community colleges all over the country.[4]Anyone with good computer skills, and especially a knowledge of AutoCAD®-type programs, could easily use this type of conversion software and produce imagery-based products to suit his own needs.[5]

Future Conflicts

What does this mean? "In a word, future U.S. adversaries will have at their disposal many of the space-based capabilities that the United States employed so effectively in 1991. They will not need to develop a space industry, launch constellations of satellites, or operate them. The prerequisites will be merely a major credit card, Internet access, and the addresses of an array of new globally owned commercial satellite service providers." [6]

Space-derived information has been used by our adversaries in the past. Iraq purchased data from SPOT Image before the invasion of Kuwait. During the conflict, SPOT completely restricted the distribution of imagery so that only the allies had it. No imagery was released to the news media, or any other unidentified customers. However, the deputy director-general of SPOT Image at that time admitted that if another company had provided its products to Iraq, SPOT Image would have also, in the interest of a competitive market.[7] Other nations are beginning to narrow the gap on the information superiority the United States once enjoyed alone.[8] In future conflicts, space technology will play a big part, but we are just now beginning to unfold its role.[9]

Effective use of digital elevation models (DEMs) demonstrates how valuable technology is in military operations. DEMs provide the measurements of elevation above a reference point, usually as "meters above mean sea level." Combined with the right software, military forces would be able to train on a realistic representation of their area of interest. In a digital battlefield simulation, troop movement and logistics placement could be rehearsed before deploying to a theater. Commanders could even see where radar towers could most effectively detect forces using line-of-site calculations.[10] Many of the previously mentioned commercial satellite imagery vendors provide DEMs; however, DEM products are also distributed by a variety of other companies. Table 2 describes some of the DEMs that are available from commercial vendors.

Joint Vision 2010 focuses on the importance of joint forces being able to maneuver quickly and flexibly and engage targets with precision from greater distances and also that logistics be more focused and more maneuverable. The underlying point is that commanders will need timely and accurate information to lead these highly mobile forces. The intelligence world and the operating forces must work together to ensure that operational decision-making requirements are in harmony with satellite capabilities. Commanders must keep in mind that the information they will be using to make tomorrow's decisions on the battlefield will be based on the capabilities of the satellites that are being built and launched today.

Maintaining Information Dominance

As dependence on the commercial industry grows, enemy forces are likely to have access to the same information that joint force commanders use.[11] How

A U.S. Navy plane sits on a runway in the South China Sea. (Space Imaging's IKONOS Satellite).

Space Imaging (DEM of 2-5-meter resolution)		
Global DEM	$105 per 10 x 10 degree tile	Multiagency license
	$14 per square degree custom tile	
	Minimum purchase is 10 x 10 degree tile	
United States DEM	$105 per 7.5 x 7.5 minute tile	Multiagency license
	$6,300 per 1 x 1 degree tile	
	$2.80 per square mile custom tile	
	Minimum purchase is 50 square miles	
*Accuracy is +/- 2 m.		
**Delivery is approximately 5 days after imagery is received.		
SPOT Image (DEM of 10-20-meter resolution)		
All scenes worldwide	$5,858.90 per scene	Scenes cover 60 km x 60 to 80 km
**Delivery is approximately 1 to 5 days after imagery is received.		
ImageLinks (DEM of 15-25-meter resolution)		
Single scene worldwide	$895 per scene	Does not include processing fee
Multiple scenes worldwide	$1,095 per scene	Does not include processing fee
*Image data collected by LANDSAT.		
**Delivery is approximately 24 hours after imagery is received.		
Intermap Technology (DEM of 2.5-meter resolution)		
North America	$3,185 per 7.5 x 7.5 minute tile	+/- 1 m vertical accuracy
	$1,910 per 7.5 x 7.5 minute tile	+/- 1.5 m vertical accuracy
	$1,590 per 7.5 x 7.5 minute tile	+/- 2.5 m vertical accuracy
Southeast Asia	$12,130 per 7.5 x 7.5 minute tile	+/- 1 m vertical accuracy
	$7,510 per 7.5 x 7.5 minute tile	+/- 1.5 m vertical accuracy
	$6,355 per 7.5 x 7.5 minute tile	+/- 2.5 m vertical accuracy
*Provides DEMs of North America, Central America, Puerto Rico, South America, Southeast Asia, and Europe only.		
**Distributors include Space Imaging, EarthWatch, OrbImage, and several others.		

Table 2. Sample of DEMs Available From Commercial Vendors

then, do we maintain information dominance? GLOBAL-97, a Navy war game, demonstrated that information superiority must be considered an operational object.[12] Early in the game, the Red Forces launched missiles at and destroyed several satellite ground receiving stations and leveled the intelligence playing field. Measures of this type of destructive attack may not work so well in a real battle. Besides the fact that both enemy and friendly forces may be using the same commercial sources for their intelligence, commercial satellites and receiving stations are sovereign property. Their destruction will just add to the complications that already exist. The best answers are yet to be found and addressed in training and doctrine revisions.[13]

In future battles, information dominance may not be in the hands of the wealthiest and most technologically advanced nation. As both sides look at the world with the same eyes, the intelligence "upper hand" will go to the nation that can use information to exploit the enemy's weaknesses quickly and effectively, while practicing higher levels of deception and operational security.[14]

Captain Wallace is the assistant S3, 40th Engineer Battalion, Germany. She was previously a plans officer with the 937th Engineer Group (C). She wrote this article while serving as a snowbird in the TRADOC Program Integration Office for Terrain Data as an assignment into threat activities. CPT Wallace is a graduate of the Engineer Captain's Career Course and holds a degree in biology from Gonzaga University, Spokane, Washington.

Endnotes:

[1] Cynthia A. S. McKinley, "When the Enemy Has Our Eyes," 1996, *http://www.fas.org/spp/eprint/mckinley.htm.*

[2] James Oberg, "SPYING FOR DUMMIES-The National Security Implications of Commercial Space Imaging," *SPECTRUM* Magazine, November 1999, *http://jamesoberg.com/articles/spy.*

[3] Thomas Behling and Kenneth McGruther, "Planning Satellite Reconnaissance to Support Military Operations," 1998, *http://www.cia.gov/csi/studies/winter98-99/art10.html.*

[4] *http://www.autodesk.com/supp/resource/atc/training.htm.*

[5] *http://www3.autodesk.com/adsk/index/0,,142985-123112,00.html.*

[6] Oberg.

[7] McKinley.

[8] Oberg.

[9] Behling and McGruther.

[10] *http://www.intermap.ca/HTML/application_military.htm.*

[11] Behling and McGruther.

[12] Ibid.

[13] Ibid.

[14] Global Trends 2015: A Dialogue About the Future With Nongovernment Experts, December 2000, *http://www.cia.gov.nic.nic_publications/index.htm.*

Masters of Terrain

By Captain Charles E. Driscoll

Before deploying to the National Training Center (NTC) for Rotation 01-05, the 1st Brigade Combat Team, Fort Riley, Kansas, faced an interesting challenge. As a baseline Legacy brigade without a division terrain team or Digital Topographic Support System (DTSS), we were hard-pressed to get quality terrain products for planning and battle tracking. The 1st Engineer Battalion applied its skills as "masters of terrain" and became the maneuver brigade's de facto terrain team, working to build a solution. Our challenge was to provide a variety of terrain products throughout the brigade, with the ability to customize products much like a division terrain team. Through weeks of NTC train-up, lots of research, and a brigade that was willing to procure the necessary tools, we were able to assemble enough "off-the-shelf" equipment to produce quality terrain products for our brigade and subordinate units. The purpose of this article is to share some tactics, techniques, and procedures (TTP) that we have developed with other brigades and battalions. Using a standard computer with the latest version of TerraBase II, a color printer, and—if available—a plotter, engineer units without the DTSS can produce high-quality terrain analysis products on their own.

Setup

About 9 months before deploying to NTC, we took a hard look at our current equipment and capabilities for terrain analysis. This is what we had to start with:

- Computer, Pentium II, 300 MHz, 128 MB RAM, 8-gigabyte hard drive.
- Hewlett-Packard (HP) Deskjet 1600C printer.
- TerraBase II, Version 4.0, software.
- Digital Terrain Elevation Data (DTED) Levels 1 and 2, Controlled-Image Base (CIB), and a Compressed Arc Digitized Raster Graphic (CADRG) of NTC.
- DTED 1 and 2 of Korea.

Although this is the minimum equipment needed for quick terrain analysis, we wanted to expand our capabilities. Specifically, we recognized the need to produce products and distribute them down to the *user* level. A TerraBase image on a computer screen may look pretty, but it is practically useless unless that information can be printed out and distributed. Thus, we established further requirements for what would become our terrain analysis station:

- Increased speed to process complex analyses and printing.
- More hard drive space to hold digital terrain data.
- Capability to print large maps and overlays.
- Capability to burn CD-ROMs.
- Imagery with more detail than the 5-meter CIB currently available.
- Additional DTEDs or Digital Elevation Models (DEMs) of home station training areas.
- Updated version of MicroDEM/TerraBase with additional functions.

Through several months of train-up, trial and error, and research, we were able to greatly expand our terrain analysis capability with the following assets:

- Micron computer, Pentium III, 800 MHz, 128 MB RAM, 20-gigabyte hard drive, Zip drive, and CD-RW.
- HP 488CA plotter with 32 MB RAM and media (36-inch rolls of paper and film).
- HP 2000C color inkjet printer.
- MicroDEM/TerraBase II, Version 5.0, software.
- Multiresolution Seamless Image Database (MrSID®) viewer software.
- Five-meter DEM of NTC.
- DTED 2 of Fort Riley.
- MrSID image of NTC (aerial photo and scanned maps) and Fort Riley.
- Printer switch box.
- Three Anvil field cases for the computer, plotter, and printer (see Figures 1 and 2).

All of this equipment is currently available, much of it through local-purchase channels. Digital terrain data is available

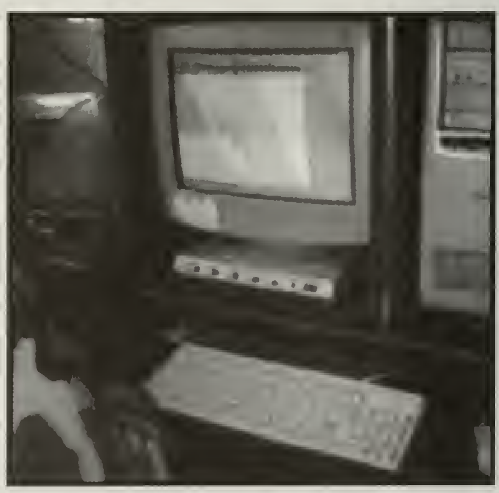


Figure 1. A computer, monitor, and keyboard arranged in an Anvil case in the M577

Figure 2. A color plotter that prints on paper and clear film fits nicely in the M577

through the supply system or from your post Integrated Training Area Management (ITAM) office, or it can be downloaded from the Internet. DEMs of the continental United States are available free from the United States Geological Survey Web site: *http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html*. TerraBase II, Version 5.0, can be downloaded from *http://www.wood.army.mil/TVC/* or at *http://www.usna.edu/Users/oceano/pguth/website/microdem.htm*.

Training

The Engineer Officer Basic and Advanced Courses currently include several hours of TerraBase II instruction, but these skills are perishable. The battalion assistant brigade engineer section refreshed its terrain analysis and TerraBase skills by reviewing the tutorial and program "Help" function. It is comprehensive and very user-friendly.

We also conducted research on the Internet, maintained a close working relationship with our post ITAM office (an excellent source for training-area digital data), and even tapped into the Kansas State University Department of Geography for additional ideas. Our initial objective was to conduct "train-the-trainer" classes within the engineer battalion and other brigade staff sections. This would later pay huge dividends; the more Battlefield Operating System elements that can conduct their own terrain analysis, the better off the brigade staff would be during the military decision-making process. Plus, it reduces the number of emergency requests to the engineers for simple terrain products. Lastly, we further customized MicroDEM/TerraBase by writing directly to the programmer, Dr. Peter Guth, who took our requests for additional functions (Print Preview, for example) and included them in the program.

Products

All too often, brigade and battalion staffs in general, and engineers in particular, receive after-action review comments from observer-controllers that reflect "insufficient detail in terrain analysis." Field Manual 5-33, *Terrain Analysis,* offers some good analysis techniques, but it is aimed toward military occupational specialty 81T topographic analysts. It does not cover how engineer staffs can apply the techniques in tactical planning. Most field manuals give a general overview of terrain analysis but rarely go beyond observation, cover and concealment, obstacles, key terrain, and avenues of approach (OCOKA). As masters of terrain, engineers must be able to merge their TerraBase skills with analyzing the military aspects of the terrain.

We used the following terrain products as decision-making tools for commanders and staffs. You can request step-by-step instructions and graphics from *pbd@wood.army.mil.*

- Aerial imagery to template enemy positions and initial point of breach.
- Database function to add and query shapefiles for overlays (see Figure 3).
- Print preview to select scale and media of final product.
- Line-of-sight analysis (weapons fans) to plan observation post locations.

Additional TTP include the following:

- Printing out oblique views of the area of operation (with chromadepth colors) to help build terrain models.
- Conducting radio retransmission line-of-sight analysis using weapons fans.
- Planning support-by-fire positions using weapons fans and intervisibility lines.
- Printing high-resolution enlargements of map sections and photos (see Figure 4, page 38).
- Using line-of-sight analysis of enemy observation posts around engineer work sites.
- Using line-of-sight analysis to plan friendly battlefield positions that cover brigade-directed obstacles.

Figure 3. A 1:50,000 modified combined obstacle overlay (MCOO) created with TerraBase II and printed on clear film

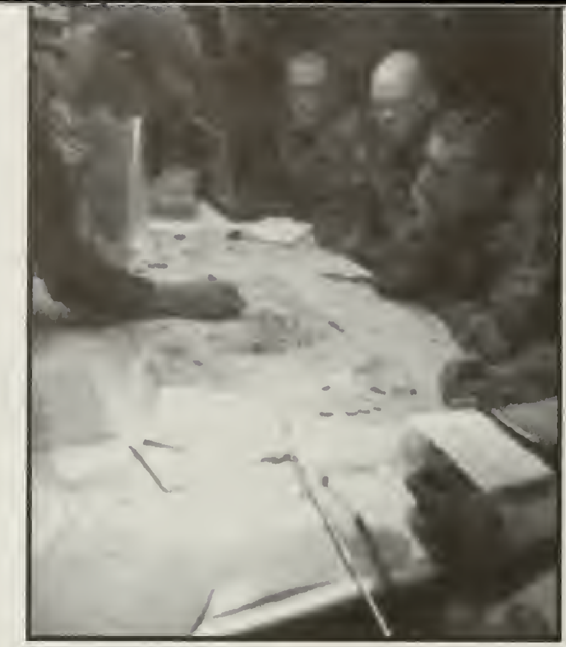


Figure 4. War gaming on a 1:20,000 map created with TerraBase II and a color plotter

- Using miniature maps for staff note-taking/sketches during war games.
- Locating precise 10-digit grid coordinates to trails or stream crossings using MrSID images.

Conclusion

The latest updates in TerraBase II and other digital terrain-viewing software keep us on the cutting edge of terrain analysis for tactical planning. Not only do we need to be proficient with this software, but we also must be able to communicate the results of our analysis through maps, overlays, and other products. Until all units begin fielding the DTSS, engineers at the brigade level and below can purchase off-the-shelf technology—the most useful of which is a plotter—to produce products. The real work, however, is selling ourselves as the subject-matter experts on merging terrain analysis technology with its applicability in tactical planning. With or without a terrain detachment, engineers at all levels must continually remind our maneuver brothers that we are the "masters of terrain."

Captain Driscoll commands Charlie Company, 1st Engineer Battalion, Fort Riley, Kansas. Previously he was the assistant brigade engineer for the 1st Engineer Battalion and platoon leader, assistant S3(training), and company executive officer in the 307th Engineer Battalion, Fort Bragg, North Carolina. A graduate of the United States Military Academy and the Engineer Captain's Career Course, CPT Driscoll holds a master's degree in engineering management from the University of Missouri-Rolla.

Notes:

1. TerraBase II images are used with the permission of Dr. Peter Guth.

2. Request additional graphics from *pbd@wood.army.mil.*

("Survivability Rehearsals," continued from page 26)

- The S3 gives an overview of the BCT scheme of maneuver and highlights the BCT commander's intent for the operation. The engineer battalion commander articulates his own intent.
- Each unit representative rehearses his action/reaction based on the enemy set. Each should be prepared to discuss how conditions are being set for key events (breaching and passage of lines).
- The S3 or executive officer identifies key decision points for the commander with specific associated criteria. He should also highlight BCT-level decision points and branch plans with associated engineer decisions and actions.
- CSS issues, such as CASEVAC support and transition to the defense (movement forward of blades and Class IV/V supplies).
- The S3 or executive officer captures all significant issues and bottom-up refinement and adds them to the commander's synchronization tools.
- The M/S rehearsal should result in a detailed rehearsal/execution tool for the commander before the CAR. This product should identify—by phase—key terrain, enemy-engineer actions, task organization and task/purpose for subordinate engineers, and key engineer decision points (action, friendly criteria, enemy criteria).

Conclusion

This is obviously not something that can be worked out for the first time at the NTC. Successful rehearsals need to be rehearsed! Hopefully, this article will help units recognize the need for M/S rehearsals while attempting to identify some TTP for consideration. Try different techniques at your home station to see what works for your team. Our observations at NTC indicate that this will more than multiply the combat effectiveness of sapper units. M/S rehearsals will likely result in a manifold increase in the synchronization of engineers across the width and depth of the battlespace, while ensuring that our BOS has the appropriate integration within the combined-arms team.

Lieutenant Colonel Magness is the engineer battalion S3 trainer on the Sidewinder Team at the National Training Center, Fort Irwin, California. Previous assignments include brigade and battalion S3, 4th Infantry Division, Fort Hood, Texas; company commander, 16th Engineer Battalion, 1st Armored Division, Germany; and platoon leader and battalion staff officer, 17th Engineer Battalion, 2d Armored Division. LTC Magness is a graduate of the United States Military Academy and the Command and General Staff College and holds a master's degree from the University of Texas.

Effective Leadership in a Garrison Environment

By Major Laurence Farrell and Colonel Allen C. Estes

Captain Smith walked into the brigade headquarters and the unpleasant feeling in his stomach worsened. Standing to his left was the company first sergeant, and in front was the battalion commander and command sergeant major. The four of them were going to see the brigade commander to explain why the awards in their units were late—again.

Approaching the command corridor, Captain Smith could clearly see the division commander's policy letter concerning awards. He had specifically instructed that when young soldiers changed duty stations, they would receive their awards in unit formations and not through the U. S. Post Office. The division commander had required a monthly status on all soldiers who left their units without their awards, along with an explanation.

As Captain Smith stood outside the brigade commander's door, he thought about what was taught at the Engineer Officer Advanced Course (EOAC). He had learned the full spectrum of engineer tasks and necessary systems that a captain must know to be an effective company commander in the Army. In EOAC, instructors addressed breaching complex obstacles, building bridges, analyzing battles, and performing a variety of other combat tasks. As he waited nervously, he wished that leadership in a garrison environment had been addressed more directly.

Many new commanders discount the importance of garrison operations and dismiss them as "paper pushing." Nothing can be farther from the truth. Garrison operations are good indicators of how a company performs in larger and more difficult missions. If a company cannot execute routine tasks, how can it accomplish difficult tasks that require a great deal of preparation? Field exercises, such as rotations at the National Training Center, require extensive coordination and administrative actions that are conducted in garrison. The success of these missions depends largely on the paperwork that is required months before soldiers depart from the motor pool and that must be followed up routinely.

How a company operates in garrison often determines its morale and esprit de corps. Deploying to the National Training Center and driving a 70-ton tank or jumping from an airplane is naturally motivating. Compare this to a 6-week-long red cycle, where morale can drop significantly in a company due to boredom. If soldiers see routine things happening routinely in garrison—such as awards, pay, and performance reports—there is a high probability that morale can be sustained. Some of the most demoralizing events that can occur in a company are when soldiers are told that their award is not ready, their promotion packets didn't make the board, or that their pay inquiries were never submitted.

Matrix Timeline for Awards

Soldier	ETS Date	Award	Award Ceremony	Platoon Leader	Company Commander	Battalion Commander
SPC Smith	1 Nov 01	ARCOM	1 Oct 01	1 Jun 01	15 Jun 01	1 Jul 01
SPC Jones	1 Nov 01	AAM	1 Oct 01	1 Jul 01	15 Jul 01	1 Aug 01

ETS – End tour of service
ARCOM – Army Commendation Medal
AAM – Army Achievement Medal

Characteristics of a Successful Commander

Although it is not meant to be all-inclusive, the following list highlights 10 characteristics of a successful commander in a garrison environment:

Executes Routine Events in a Timely Manner. A successful company commander ensures that routine events occur routinely and on time. The administrative burden on a commander includes everything from reenlistment counseling, family care plans, and the overweight program to monthly inventories, urinanalysis testing, and unit status reports. These tasks simply cannot be accomplished without organized systems in place and clearly defined responsibilities. In the scenario on page 39, the chain of command obviously did not intend to insult soldiers and not have an award ceremony; however, due to an inability to track the progress of a routine event, the result was the same. It is clear that the company commander had a systematic failure in his company.

In a traditional table of organization and equipment company, there were at least two noncommissioned officers (NCOs) (squad leader and platoon sergeant) and an officer (platoon leader) who should have been accountable long before the deadline was missed. The system that a commander implements in his unit must be easy to understand and must hold individuals responsible for completing clearly described tasks by a published suspense date. Visual tracking tools may be used, such as the matrix timeline for awards above. This matrix clearly shows all suspenses and the people responsible for meeting them. Any tracking tool should be actively used, periodically reviewed (such as at staff meetings), and regularly updated, rather than serve as part of an SOP on a shelf.

This technique can be applied to a variety of garrison tasks, such as Noncommissioned Officer Evaluation Reports, Article 15s, reports of survey, mandatory annual training, quarterly training briefs, and even dental appointments. A commander's time is precious. He defines what information he wants to see and leaves the system to his subordinates to design, even if it is an iterative process. Such systems, once in place, greatly reduce the amount of time and effort a commander spends on routine events.

An effective leader is not late for meetings or in completing routine taskings. In a garrison environment, there is rarely a justifiable excuse for missing suspenses; companies that frequently miss suspenses are undisciplined. The ultimate effect of missing suspenses is a breakdown in trust and confidence between the battalion commander and the company. Battalion commanders are usually not unreasonable. If a deadline is going to be missed, bring it to the commander's attention as soon as possible, not the day before the suspense is due. Explain why it will be late, what you have done to correct the situation, and what you think the new due date should be.

Uses the Battalion Staff and Delegates Properly. Most company commanders are hardworking, enthusiastic, and

Recognizing good performance and including families in unit events will help show soldiers that the commander cares about them.

"In the Army, perception becomes reality. Units that think they are good often perform better than other average units with similar training and resources. A unit that looks professional and well organized generally is."

dedicated to their units. However, to be effective, they must seek support from the battalion staff when necessary and delegate as much as possible to subordinate leaders.

Company commanders who receive missions from battalion headquarters must insist that the battalion staff does enough preliminary planning to determine if the mission is appropriate, feasible, and doable by a company unit before passing on the mission statement. In a battalion mission, the battalion staff is the planning agent, and the company is the executing agent. After receiving the plan, an effective company commander properly delegates as much as possible to the platoon leaders and monitors the execution of their missions. A commander cannot sit on information; he must get it into the hands of the executors, even if it is incomplete. To delegate properly, he must give maximum authority and responsibility to subordinate leaders but must be willing to take blame and provide forgiveness when subordinates make mistakes.

Shows Concern for Soldiers and Their Long-Term Goals. Soldiers are motivated by a wide variety of concerns and goals. If a company commander can convey the sense that these concerns and goals are personally important, the performance of the unit will increase significantly. One effective and simple example is to provide the soldiers with a college recommendation. Many soldiers enter the Army today for the educational benefits that are provided in the Montgomery G.I. Bill. They serve their country honorably, leave the service, reenter their community, and attend college. Although it should not be automatic, these soldiers are sometimes entitled to a college or future-employment recommendation from their company commander. This provides a great morale boost to the soldiers, and they often become great recruiters for the Army in the community.

Other ways to show concern include sending congratulatory notes to soldiers who complete correspondence courses, conducting meaningful reenlistment ceremonies, providing photos of unit events to soldiers in the photos, publishing articles in the post newspaper using names and quotes from soldiers, and personally meeting with soldiers as they arrive and depart the unit. The possibilities are limited only by the imagination of the commander and his staff.

Get to know a soldier's family, and include them whenever practicable in unit activities. At a minimum, this should include newcomer briefings, organization days, and social events. When a married soldier is not at work, he is usually at home with his family. Conditions at home can greatly affect performance at work. Making the effort to know a soldier's family cannot help but further the perception of caring. A spouse who understands what the unit is doing and feels a part of it is far more likely to be sympathetic to the demands of the soldier's job.

Is Neat and Organized. In the Army, perception becomes reality. Units that think they are good often perform better than other average units with similar training and resources. A unit that looks professional and well organized generally is. As a commander, the first step in transforming an average unit into a great unit is cleaning the company area. Bookcases should not be filled with outdated field manuals. Company "IN" boxes should not simultaneously serve as file cabinets. All paperwork must be filed and handled according to the Modern Army Record-Keeping System.

For a successful commander, the end of the duty day is an ideal opportunity to think about, prepare, and prioritize the tasks and missions that must be accomplished the following day. He should set up a general schedule that represents how he is going to allocate his most precious resource—time. This preparation allows immediate execution of the priority missions at the beginning of the next duty day and ensures organization and thoroughness.

Although it is difficult to do so, every commander should allocate some quiet time to simply think. In the rapid pace of day-to-day events, it is commonplace to react to crises without developing a long-term plan or vision for the unit. Many hard-charging, dedicated commanders feel guilty when they seek solitude for contemplation, but that is how visions are developed; without this time, a unit can easily lack direction.

Prioritizes Missions. A company commander should have a clear understanding of his priorities. He should have two or three long-term priorities that receive most of his effort and focus. At least one of these areas should be directly in line with the battalion and brigade commanders' guidance. For example, if the number-one goal of brigade and battalion quarterly training is to improve physical fitness performance, then obviously this needs to be the number-one priority of the company's quarterly training. The second priority could easily be the commander's personal goal—even if it is not on the bosses' list—such as winning the Chief of Staff's Supply Excellence Award.

A company cannot excel at everything, but a commander can maintain and sustain performance in important events such as rifle marksmanship, physical fitness, and command-inspection areas. Understanding this prevents the "everything-is-a-priority" syndrome from occurring at the company level and prevents soldiers from being worn down. Maintaining and

The command team should establish good working relationships with post agencies and invite them to visit the unit.

consistently communicating a few priorities over the long term help soldiers understand your philosophy and prevent a unit from losing focus.

Knows the Job of His Subordinates and Superiors. Ensure that the executive officer (XO) and first sergeant know—and are comfortable with—the daily functions and duties of being a commander. In essence, they should know your job. Ensure that the XO knows the supply and operation sergeants' jobs. And, as a commander, you should know the XO's job. This vertical and horizontal integration is truly a sign of an excellent unit. How many times have you requested information or support and were told, "Sergeant Smith handles those requests, and he is on leave." Ironically, this lack of vertical integration typically occurs at the headquarters level in a company.

Compare the following two examples: In a routine company, when the platoon sergeant goes on leave, the senior E-6 in that platoon automatically fills the position, and no loss of mission occurs. However, in the same company, when the supply sergeant goes on leave, the whole company dreads it because the availability of necessary supplies becomes an issue. If the company is vertically integrated, the XO and training NCO can perform the supply sergeant's duties with no loss of mission.

Besides knowing the job of subordinates, it is important in the development of subordinates that they know the job of their superiors. The classic example is the XO filling the duties of the commander when necessary. This should also extend down to the operations sergeant. When the XO goes on leave, the commander covers down on some of the duties and responsibilities of the XO, while the operations sergeant covers up. This vertical integration results in no loss of mission and truly sets a unit apart from other units that seem to stall and sputter when key personnel take leave. The temporary loss of a key member should be viewed as a leadership-development opportunity for a promising subordinate.

Makes Tough Calls. An effective leader ensures that an appropriate decision is made for the proper performance. Sometimes leaders have to make a tough call when it is clearly required. For example, the commander recommends a staff sergeant who has been a squad leader for 18 months for a Meritorious Service Medal. This award is unusual in many commands, but under "guidance" and recommendations from the first sergeant, platoon leader, and platoon sergeant, a captain may be easily convinced to recommend approval and forward this to the battalion commander. This puts the battalion commander in a bind. If the soldier truly deserves the award, the solution is to recommend approval. However, if the soldier does not deserve the award, the battalion commander must recommend disapproval, which contradicts the company commander. The battalion commander has now become the "bad guy" in the award process. This disconnect between the two commanders is the fault of the company commander whose credibility is now lessened. The company commander was unwilling to make the difficult decision and, as a result, put the battalion commander in a bind.

An unwillingness to make tough calls is a weakness that can extend beyond awards. Does the commander "chapter" from the service a soldier who clearly does not deserve to wear the uniform, or does he transfer the soldier to a different unit under a "rehabilitative transfer?" In the company, do all soldiers go in front of the promotion board regardless of whether they deserve and are ready for promotion? It takes more courage and leadership to explain to a soldier that he is not ready for promotion and tell him what he must do to get promoted. Failing to make tough calls cheapens special recognition, such as awards and promotions, and leaves commanders with nothing special to offer the truly best soldiers who have put forth extraordinary effort. It reduces the motivation for everyone to exceed the standard.

Conducts Physical Training. An effective commander ensures that rigorous physical training occurs at least three times a week. One reason soldiers enlist in the Army is to be physically challenged. While many of the requirements that take away from physical training come from the battalion level or higher, many companies misuse their physical-training time. At the company level, physical training must be challenging and imaginative and have variety. It should not consist of sports. Physical training must be viewed as an event that prepares soldiers for war—and their semiannual physical training test. Sporting events that provide esprit de corps and unit cohesion are great additions to an already-strong program. However, most team sporting events do not provide a sufficient workout for a platoon-sized element.

Physical training usually occurs early in the morning when most soldiers would rather be sleeping. To set the proper tone for the physical training, the chain of command must be there and participate.

If a commander's physical training occurs three days a week—Monday, Wednesday, and Friday—with Tuesday and Thursday reserved for "sergeant's time" and command maintenance, physical training can be incorporated into sergeant's time also. This can easily be accomplished through the time-honored event of road marching. Incorporating a weekly 3- to 5-mile road march into sergeant's time provides two benefits: First, done properly (with a rucksack), it quickly raises an individual's Army Physical Fitness Test score; second, it adds realism to the sergeant's-time training. The 3-day-a-week physical-training schedule has now become a 4-day-a-week schedule, resulting in more physically fit and better-trained soldiers. The road march, though simple, is a win-win solution for the commander and the soldiers.

Leads From the Front. Too often, a company commander leads from behind a desk. Soldiers expect to see their commander at training sites and in the motor pool, executing the tasks that they are directly responsible for. In Army doctrine, the commander is placed at the point where he can have the greatest effect and influence on the occurring event. On a range, this is the officer in charge (OIC). He is directly linked to the NCO in the tower and the range safety and control personnel and easily has the greatest impact.

The effect of a company commander performing the duties of a range OIC for a company-sized range is immense. The NCOs who run the range develop a sense of ownership as they see their commander actively engaged in range activities. The efficient commander leverages such opportunities to talk with soldiers, shake hands, pat backs, and keep abreast of what is happening in the unit. However, this is often not what actually happens. More likely is that the company commander comes out from 1000 to 1200 hours and then goes back to the orderly room. If something is urgent at the company headquarters, the commander should instruct the executive officer—who by definition is the headquarters platoon leader—to accomplish the mission. Again, he is the deputy and must be able to replace the company commander on a moment's notice.

The company commander cannot be the OIC on all the company's ranges, but over the period of a command, the opportunity presents itself more than once where the commander can fill this role. Leading from the front is a mentality. It consists of being at physical training, leading the road march, and taking the annual company common-task-training test. On command maintenance days, it means that the commander is in the motor pool all day, not just in the morning. It also means that the commander performs maintenance on his vehicle, demonstrating the importance of ownership. Leading from the front consistently is a time-intensive practice. There are many events that can require the commander's presence. But if troops see him leading from the front, they truly appreciate it and will be more likely to want to serve and excel in the company.

Knows the Post Agencies. Thoroughly understanding how post agencies operate and knowing the unit representatives are effective and simple methods of ensuring that soldiers are taken care of in times of need. Most commanders are not experts on counseling marriages, treating alcoholism, preparing wills, registering to vote, solving pay disputes, or registering weapons. In today's Army, there are numerous post agencies that are created solely for the benefit of soldiers. If a commander understands the services that these agencies provide and knows whom to call, many problems can be prevented. A good example is the class offered by the Army Community Service that teaches soldiers basic money management.

Working with post agencies is one area that is well suited for delegation, especially among the company headquarters. The first sergeant may be the person to facilitate the relationship with the unit's TRICARE representative, while the operations sergeant could handle requests that go to the Army Emergency Relief fund or the Army Community Service. Having a good working relationship with the post support agencies translates to faster and better help for soldiers.

Summary

A commander's duties and responsibilities in garrison are numerous and tremendously important. They are often thankless and extremely time-consuming. Although the mission and purpose of the Army is to fight and win the nation's wars, there is a tactical component and a garrison component to this mission. Reducing the amount of time and effort spent on garrison tasks will free up time and energy to focus on critical wartime tasks—which are essential for survival—and will improve the morale of your unit.

Major Farrell is an instructor in the Department of Civil and Mechanical Engineering at West Point. He previously commanded Alpha Company, 35th Engineer Battalion (OSUT), Fort Leonard Wood, Missouri. MAJ Farrell has served combat tours in Saudi Arabia (Operations Desert Shield and Desert Storm) and Somalia (Operation Restore Hope). He is a graduate of the Virginia Military Institute and holds a master's degree in civil engineering from the University of Missouri at Rolla.

Colonel Estes is the director of the Civil Engineering Division in the Department of Civil and Mechanical Engineering at West Point. He previously commanded the 169th Engineer Battalion (OSUT), Fort Leonard Wood, Missouri. COL Estes served a combat tour in Somalia (Operation Restore Hope) as the battalion S3 for the 43d Engineer Battalion, Fort Benning, Georgia. He is a graduate of the United States Military Academy and holds a doctorate in civil engineering from the University of Colorado.

Response to "Where Is the MTOE Guy?"

By Mr. Garry N. Hamlet

To answer Captain Chamberlyne's article (*Engineer*, August 2001, page 41), the modified table of organization and equipment (MTOE) guy is in the unit's major command (MACOM) headquarters. Personnel at Forces Command (FORSCOM), the United States Army Pacific Command (USAPAC), the National Guard Bureau (NGB), the Office Chief of Army Reserves (OCAR), and United States Army Europe (USAREUR) develop the MTOEs for the units assigned to their commands. However, all MTOEs are based on a table of organization and equipment (TOE), which the proponent schools design and develop. The Engineer Organization Branch of the Maneuver Support Center's Directorate of Combat Developments develops engineer TOEs. Most issues are TOE and not MTOE issues. The MTOE merely reflects what is documented on the TOE for a particular MACOM.

The TOE is a requirements document. It contains only the minimum mission-essential wartime requirements necessary to accomplish an organization's doctrinal wartime mission. TOEs do not document personnel and equipment for peacetime functions or to support operations other than war. Every three years, a TOE is reviewed to make necessary adjustments to meet current documentation rules and apply requested changes from various sources, including a review of comments from the field. The MTOE is the authorization document and, even though it is updated every year, it typically lags three years behind the latest change to the TOE.

Factors exist that cause MTOEs to differ from TOEs. Because of the costs involved in maintaining units at a high level of readiness, the Army has organized units in stratified levels of readiness based on a unit's response time according to war plans. One way to accomplish this stratification is the authorized level of organization (ALO), which normally refers to personnel and the percentage to which a unit is staffed. TOEs have only three levels of organization: 100, 90, and 80 percent. When manned to any of these three levels, the unit, in theory, should still be able to accomplish its doctrinal wartime mission. However, MTOEs have eight ALOs. Once a unit's authorized strength level falls below the 80 percent required-strength level, its wartime mission capabilities are impacted.

Another way of stratifying an organization is the Department of the Army Master Priority List (DAMPL), which affects the authorization of equipment systems and personnel manning to the organization. DAMPL prioritizes which units will receive equipment and personnel primarily based on which units will be "first to fight." Because the Army rarely buys 100 percent of the equipment requirements, this action affects which units will actually be fielded certain items of modernization equipment. Note, some reserve organizations are higher on the DAMPL sequence than active units.

Other reasons MTOEs differ from TOEs are the use of authorized in-lieu-of (ILO) items and exceptions to the MTOE. If a unit lacks 5-ton cargo vehicles, it may receive a 2.5-ton cargo truck as an ILO item. MTOE exceptions, which do occur in National Guard organizations, document a capability to support a particular state mission requirement.

Over the years, the Engineer School found that the majority of the units' major issues concern the TOE and tend to be the same basic issues. One major point is that when designing and changing a TOE, cost is seldom the determining factor. Adding to the TOE without causing overall growth to the engineer force structure, using regulations, doctrine, and availability of personnel spaces as justification, is a factor. Below are some of the most common TOE issues that the Engineer School has heard over the years and explanations as to why the TOEs have or have not been changed.

High Mobility, Multipurpose Wheeled Vehicle (HMMWV) for the First Sergeant

This is a common Armywide issue, not an engineer-specific one, which has been raised numerous times to the DA staff. No unit according to the TOE receives a HMMWV specifically for the first sergeant. Good arguments and justifications have been submitted; however, DA has nonconcurred. Its rebuttal has been that the first sergeant can use the company supply vehicle. However, since Force XXI units have presented the issue, it is still open. One major stumbling block is that there is a shortage of 10,000 HMMWVs to meet current TOE requirements.

Mix of Armored Combat Earthmovers (ACEs) and Dozers

This issue was originally proposed by then Colonel Anders Aadland, commander of the 2d Armored Division Engineer Brigade. Over the years, the issue has been raised several more times with various mix quantities each time. The Engineer School made the final decision that there would not be a mix of dozers and ACEs in the TOEs. Dozer assets exist at the corps level, specifically the combat support equipment company, that was designed to augment divisional capabilities. That was part of the overall concept involved with the redesign of the engineer support to the heavy division as we moved from an engineer battalion to an engineer brigade.

Changes to Communications Equipment

Communications equipment continually evolves and changes in the TOE, based on field input. The process of changing communications equipment involves gaining approval by the operational facility (OPFAC) board, which uses a series of rules to provide communications equipment to positions and organizations. For example, a battalion commander in an engineer battalion, heavy division, gets different equipment than a battalion commander in a topographic battalion. When a change is submitted to the OPFAC board, it evaluates the request based on doctrine and the communications nets used. It balances this against the rest of the divisions' and corps' communication nets to see if there are enough nodes for the equipment to function as planned. The current TOEs document the maximum amount of communications equipment that the OPFAC board has approved.

Capturing the Loss of Capability Associated with Eliminating the Combat Engineer Vehicle (CEV)

Over the years, many proposals have been recommended about this issue. DA directed eliminating the CEV and associated personnel requirements for what it saw as an essentially unsupportable vehicle. As the Army continued to downsize, CEV personnel positions were reallocated. The Engineer School was promised that the positions would be returned when the Grizzly was fielded. However, the Grizzly program is currently in jeopardy with only the Force XXI organizations still reflecting a requirement. If the Grizzly program is killed, a variation of the heavy division Force XXI TOE exists, which was approved by the Engineer School leadership, in which the third squad per platoon and the number of ACEs are increased to offset the lost capabilities. For all non-Force XXI units, the capability and personnel are still lost.

Adjustments to Various Quantities of Weapons and Night-Vision Devices

Many of these systems have been adjusted in the TOEs. The Engineer School is currently reviewing the various mixes of night-vision sights and goggles with the Infantry School, the proponent for these devices, for approval to make changes in the basis of issue. The goal is to have the same basis of issue as the infantry.

Additional Maintenance Personnel in Various Military Occupational Specialties (MOSs)

The number of positions in a TOE for maintenance is based on the estimated number of hours per piece of equipment required per year to keep the systems operational. This is known as the manpower requirements criteria (MARC). It is not based on a ratio of mechanics to rolling stock or ratio to radios, as is often cited by units when comparing their maintenance sections to that of the maneuver forces. All engineer TOEs are documented to the full number of mechanics as authorized by MARC. To add a position, the Engineer School would have to request a deviation, which would require identifying a position from another source due to the zero-sum-gain policy in the Army's force structure. MARC is not a perfect system, and the Army is aware of the problems. The Army Materiel Command is currently working to establish a study to reevaluate the hours assigned to various pieces of equipment.

More MOS 92As to Operate the Unit-Level Logistics System-Ground (ULLS-G) Boxes

According to MARC, the ULLS-G requires one 92A per box to operate. To add more personnel means identifying positions from another source because of the zero-sum-gain policy. The structure of many TOEs was determined when they were originally designed; risks were accepted in that area to sell the overall concepts.

Conclusion

I encourage units with an MTOE problem to contact me or the Organization Branch at (573) 596-0131, ext 3-7236. We will assist you in analyzing whether it is an MTOE or a TOE problem. We can also explain the logic behind how the TOE was documented and if there is a possibility of achieving any of your unit's proposed changes. If it is an MTOE-only problem, the installation's Force Modernization Office can assist you or you can contact your MACOM. The point of contact for FORSCOM units is Captain Robert Kroning, (404) 464-7729; the Office Chief of Army Reserve is Lieutenant Colonel O'Conner, (703) 601-0649; and the National Guard Bureau is Lieutenant Colonel Steven Jahner, (703) 607-7824.

Mr. Hamlet is the chief of the Engineer Organization Branch, Maneuver Support Center, Directorate of Combat Developments, Fort Leonard Wood, Missouri. He has been involved with the documentation of engineer TOEs for the last 15 years.

Due to recent events, current and back issue of *Engineer* are unavailable online. If you would like a copy of an article, send your request to: *pbd@wood.army.mil*. Please include your organization or unit and your reason for requesting the article. Include the issue of *Engineer* and the date of publication. The table of contents for the February 2001, May 2001, August 2001, and February 2002 issues can be found at *http://www.wood.army.mil/engrmag/emag_hp.htm*.

PERSCOM Notes

Olmsted Scholarship—Adventure of a Lifetime

By Captain Michelle Anderson

Adventure of a lifetime—this is what the Army Recruiting home page promises today's youth who are brave enough to embark on a military career. For many soldiers, this adventure includes the mountains of Korea, the deserts of Saudi Arabia, the streets of Haiti, the jungles of Panama, and other exotic locations. As engineers, we can expect multiple opportunities for travel. But the adventure does not have to be restricted to short-tour locations, peacekeeping missions, and deployments. How would you like to spend a couple of years in Paris, Rio de Janeiro, Buenos Aires, or Brussels? Instead of patrolling the streets, how about strolling through the streets with your family taking in the local shops, cuisine, and entertainment? Rather than handling personnel, logistical, and maintenance challenges, how about the challenge of pursuing graduate studies taught in a foreign language at a foreign university? An opportunity exists for just such an adventure—the Olmsted Scholarship Program.

Major General [Retired] George H. Olmsted stated,"The United States is one of the major forces in the world today. As a consequence, its military leaders come into contact with citizens and military leaders of many nations. Relationships between nations require a unique consideration of many factors including political, economic, and military. It is not enough to know one's own strengths, weaknesses, and general characteristics. The solutions of difficulties that arise between nations require knowledge and depth of understanding of the particular nations involved." General Olmsted served in the War Department, North Africa, and China during World War II. His experiences, particularly in China, convinced him that American military leaders lacked exposure and sensitivity to foreign cultures. Therefore, to educate young military officers in foreign cultures to better prepare them for senior leadership in the military, he established the Olmsted Scholarship Program in 1959, in cooperation with the Department of Defense.

Annually, the George and Carol Olmsted Foundation awards an educational grant to officers from the Army, Navy, and Air Force, to participate in 2 years of graduate education at a foreign university. The intent of the program is to immerse the officers and their families in a foreign culture, where the officers are expected to familiarize themselves with the institutions, customs, language, and people of the host nation. Before reporting to the country, the officers attend intensive language training to prepare for study in a foreign language. Spouses also receive grants for language training. Finally, due to the inherent challenges of earning a degree at a foreign university, the Olmsted Foundation offers an additional modest grant to scholars to pursue a graduate degree upon returning from overseas or anytime during their military career. They must, however, coordinate with their career branch before accepting the grant.

The Olmsted scholarship provides a unique, relevant, and enduring career opportunity. Major General Bruce Scott, the senior Army Olmsted scholar on active duty, serves on the Board of Directors of the Olmsted Foundation. MG Scott, an engineer, was in the Olmsted scholar class of 1979 and attended the University of Freiburg, Germany. He earned many opportunities to use his experience as an Olmsted scholar. He commanded the 16th Engineer Battalion and the Engineer Brigade, 1st Armored Division—both located in Germany. He also served as a White House Fellow and on several senior Army and Department of Defense staffs. His duties have included military assistant to the Executive Secretary for the Secretary of Defense; executive assistant to the Vice Chairman of the Joint Chiefs of Staff; and chief, legislative liaison, Office of the Secretary of the Army. MG Scott is currently the commanding general, U.S. Army Security Assistance Command.

The Olmsted scholarship also provides an excellent personal opportunity for the military scholars and their families. Colonel Dave Ridenour, commander of the Pittsburgh District, U.S. Army Corps of Engineers, attended the University of Innsbruck in Austria as a 1982 scholar. He states, "We had a great family experience. My wife, children, and I consider the village of Mils, Austria, as our second home. The people we met and became friends with are friends for life." He adds, "For me, the experience was invaluable. I realized the importance of learning another language and culture." Colonel John W. Peabody, commander of the Engineer Brigade, 3d Infantry Division, attended El Colegio de Mexico and refers to the Olmsted Scholarship Program as the "best deal in the Army."

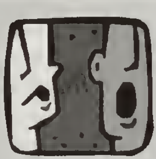
Name	Current Rank	Undergraduate University	Olmstead Class and University
Le Cuyer, Jack A.	Colonel (Retired)	USMA 1966	1970 – University of Florence, Italy
Giordano, Frank R.	Brigadier General (Retired)	USMA 1964	1971 – University of Madrid, Spain
Dunn, Richard James III	Colonel (Retired)	Bucknell University 1969	1976 – National Cheng Chi University, Taiwan
Scott, Bruce K.	Major General	USMA 1972	1979 – University of Freiburg, Germany
Ridenour, David R.	Colonel	USMA 1975	1982 – University of Innsbruck, Austria
Vogel, William S.	Colonel (Retired)	USMA 1975	1982 – University of Mexico, Mexico
McClure, Robert L.	Colonel	USMA 1976	1983 – Gutenberg University, Germany
Sole, Thomas R.	Major (Retired)	USMA 1980	1986 – Institute of Political Studies, France
Fullerton, William B.	Lieutenant Colonel	USMA 1981	1987 – Pontifical Catholic University of Rio de Janeiro, Brazil
Grewatz, Vincent E.	Lieutenant Colonel	USMA 1982	1988 – University of Munich, Germany
Peabody, John W.	Colonel	USMA 1980	1988 – El Colegio de Mexico, Mexico
Jordan, John D.	Lieutenant Colonel	University of Toledo 1982	1992 – University of Zurich, Switzerland
Raymer, James H.	Major	USMA 1989	1998 – National University of Tucuman, Argentina
Ursitti, Elias	Captain	USMA 1993	2001 – University of Petersburg, Russia
Mategrano, Albert	Captain	USMA 1991	2002 – Institute of Political Studies, France

The Engineer Regiment boasts several other Olmsted scholars. They include Captain Elias Ursitti, who began studies at the University of St. Petersburg in Russia this fall, and Captain Albert Mategrano III, who will study at the Institute of Political Studies in Paris, France, once he completes language training. The chart above lists engineer Olmsted scholars spanning more than 30 years.

Are you interested in competing for an adventure of a lifetime and adding your name to this list of distinguished engineer officers? Check out *www.perscom.army.mil/opfamacs/FELLOWS07.htm* for information on eligibility criteria and application procedures. The primary target is branch-qualified captains. The next PERSCOM Olmsted selection board meets in February 2003. Interested officers should contact their assignment office. You must be available not later than August 2003.

General Olmsted believed that "the greatest leaders must be educated broadly." This education can take place during any assignment at any location. The Army offers multiple chances for adventure. The Olmsted scholarship is just one of many opportunities available to the Engineer Regiment. It may be just the adventure you and your family are looking for.

Captain Anderson is the non-branch-qualified captains' assignments and future readiness officer. Previously, she was the chief, civilian education, at PERSCOM, responsible for executing the Army's advanced civil schooling, training with industry, and fellowship/scholarship programs.



Did You Know?

Due to recent events, the 2002 Engineer Unit Directory is unavailable online. It is also not available in printed format. If you would like a copy of the Microsoft Word document file (1,102KB), send your request to:

pbd@wood.army.mil

If there are changes to your unit's listing, please let us know.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

New Leadership. The following senior leaders arrived in DOT since our last publication:

- COL Jeffrey LaMoe, Director of Training, 34093; DSN -4093; or e-mail *lamoej@wood.army.mil.*
- SGM MacArthur Edmundson, Sergeant Major, DOT, 34094; DSN -4094; or e-mail *edmundsonm@wood.army.mil.*
- LTC Jeffrey Bedey, Director, Department of Instruction (DOI), 35647; DSN -5647; or e-mail *bedeyj@wood.army.mil.*
- LTC William Duddleston, Chief, Doctrine Development Division, 37537; DSN -7537; or e-mail *duddlestonw@wood.army.mil.*

Organizational Changes. DOT has made two significant structural changes. First, we elevated the Countermine Training Support Center/Humanitarian Demining Training Center from under DOI to a position directly under the Director of Training. Second, the environmental staff is now directly under the assistant commandant. Both changes reflect the increased presence and visibility of these activities.

WANTED! Applicants for Terrain Analysis Technician Warrant Officer. NCOs in MOS 81T with 4 to 12 years of service may apply. You can find the duty description in DA Pam 611-21, *Military Occupational Classification and Structure*. Information on how to become a warrant officer is on the Warrant Officer Career Center home page, *http://leav-www.army.mil/wocc/*. The accession board is slated for May 2002, and you must submit your packet to the appropriate component by 26 April 2002.

POC is CW4 Frederick Kerber, 34088; DSN -4088; or e-mail *kerberf@wood.army.mil.*

ASI 2S (Battle Staff Operations). Revisions will add coding for selected table of organization and equipment (TOE) and modified TOE positions as engineer operations sergeant and construction foreman in the following positions:

TOE	Unit	Para/Line No	Section	Title	Grade
05336L000	HHC, Engr Bn Hvy Div	08/01 08/02	Assistant brigade engineer	Operations sergeant Construction foreman	12B40 12B30
05053L000	Engr Co, ACR	07-02	Regimental engineer	Operations sergeant	12B40
05156A000	HHC, Engr Bn Inf Div Lt	14/02 14/03	Brigade engineer	Operations sergeant Construction foreman	12B40 12B30
05216A000	HHC, Engr Bn Air Asslt	16/02 16/03	Brigade engineer	Operations sergeant Construction foreman	12B40 12B30
05153L000	Engr Co, Sep Inf Bde	07/02	Brigade engineer	Operations sergeant	12B40
05113L000	Engr Co, ACR	08/02	Regimental engineer	Operations sergeant	12B40
05143L000	Engr Co, Hvy Sep Bde	08/02 08/03	Brigade engineer	Operations sergeant Construction foreman	12B40 12B30
05026A000	HHC, Engr Bn, Abn Div	14/02 14/03	Brigade engineer	Operations sergeant Construction foreman	12B40 12B30
05336F000	HHC, Engr Bn, Hvy Div	05/02 05/03	Assistant brigade engineer	Operations sergeant Construction foreman	12B40 12B30

Center for Engineer Lessons Learned (CELL). We are continually updating the lessons learned Web site, and we are working with the Center for Army Lessons Learned at Fort Leavenworth, Kansas, to link our two databases/Web sites. We thank units that have sent electronic copies of their tactical SOPs, which are on the Engineer School CELL Web site at *http://www.wood.army.mil/CELL/index.htm*. We ask units that have developed a Leader Certification Program to send an electronic copy of their documents to be posted on the Web site as well. Also, please continue to forward engineer lessons learned from exercises and operations. Others can benefit from your experiences. Contact this office if you have questions about engineer lessons learned, the digital SOP, or the Leader Certification Program.

POC is Mr. Reggie Snodgrass, 37762; DSN -7762; or e-mail *snodgrar@wood.army.mil.*

The Army School System FY01/02 Accreditation/Assessment Visits. Accreditation evaluations of Region B (80th Division [IT]), Region E (84th Division [IT]), and 4960th Multifunctional Brigade, Hawaii, are complete. All three organizations were accredited. The assessment evaluations of Regions A (98th Division [IT]), C (108th Division [IT]), D (100th Division [IT]), F (95th Division [IT]), and G (104th Division [IT]) are complete. During FY02, Region C (108th Division [IT]); Region F (95th Division [IT]); Region G (104th Division [IT]); and the Combat Support Battalion, 8th Brigade (108th Division [IT]), Puerto Rico, will be evaluated for accreditation. All other regions will undergo assessment evaluations.

POC is MAJ James Avants, 34114; DSN -4114; or e-mail *avantsj@wood.army.mil.*

Countermine Operations and Humanitarian Demining. Our U.S. and international demining staff at the Countermine Training Support Center/Humanitarian Demining Training Center is ready to assist you in training, training-support, or predeployment information. Our Web site is *www.wood.army.mil/ctsc.* Our services and POCs are as follows:

- Mine-awareness mobile training teams—MAJ Mark Griffin, 36199; DSN -6199; or e-mail *griffinma@wood.army.mil.*
- Mine-awareness training aids and countermine questions—Mr. Mike White, 36199; DSN -6199; or e-mail *whitemi@wood.army.mil.*
- Humanitarian demining operations training—SGM Kevin Fee, 36199; DSN -6199; or e-mail *feek@wood.army.mil.*

Engineer Captain's Career Course. Classes for FY02 are as follows:

Class	Report	Start	End
ECCC 1-02	09 Nov 01	13 Nov 01	04 Apr 02
ECCC 2-02	15 Mar 02	18 Mar 02	23 Jul 02
ECCC 3-02	03 May 02	06 May 02	11 Sep 02
ECCC 4-02	09 Aug 02	13 Aug 02	19 Dec 02

Class	Report	Start	End
ECRC 2-02	30 Nov 01	03 Dec 01	14 Dec 01
ECRC 3-02	18 Jan 02	22 Jan 02	24 Feb 02
ECRC 4-02	22 Feb 02	25 Feb 02	08 Mar 02
ECRC 5-02	12 Apr 02	15 Apr 02	26 Apr 02

POC is MAJ Steve Cross, 34128; DSN -4128; or e-mail *crosss@wood.army.mil.*

Engineer Precommand Course. Classes for FY02 are as follows:

Class	Report	Start	End
003	13 Jan 02	14 Jan 02	25 Jan 02
005	03 Mar 02	04 Mar 02	15 Mar 02
007	07 Apr 02	08 Apr 02	19 Apr 02

POC is Mr. Ed Zielonka, 37061; DSN -7061; or e-mail *zielonke@wood.army.mil.*

Directorate of Training Development (DOTD)

Engineer Bradley Fighting Vehicle. Although there have been minor modifications in the Bradley A3 fielding plan due to the refinement of the Army's Transformation Campaign Plan and the Unit Set Fielding Strategy, the plan for fielding M2A2-Operation Desert Storm (ODS) vehicles to III Corps and 2d Infantry Division engineer units remains essentially unchanged.

Higher HQ	Unit	Quantity	ODS Source	ODS Turn-In	Digital Upgrade (funded separately)	OPNET
1 Cav	91 Engr	29	2-5 Cav, 1 CD	Sep - Dec 01	Mar - Jul 02	Jul - Oct 02
1 Cav	20 Engr	29	2-5 Cav, 1 CD	Sep - Dec 01	Aug - Nov 02	Jan - Mar 03
1 Cav	8 Engr	29	1-9 Cav, 1 CD	Dec 02 - Mar 03	May - Sep 03	Aug - Dec 03
4 ID	299 Engr	29	2-7 Cav, 1 CD	Mar - May 03	Jun - Oct 03	Aug - Dec 03
4 ID	588 Engr	29	2-7 Cav, 1 CD	Mar - May 03	Jul - Nov 03	Jan - May 04
4 ID	4 Engr	29	2-7 Cav, 1 CD (5) 1-22 Inf, 4 ID (24)	Mar - May 03 (1 CD) 2 Qtr 04 (4 ID)	Aug - Dec 03 (1 CD) N/A (4 ID)	Jun - Sep 04
3 ACR	43 Engr Co	13	1-22 Inf, 4 ID (24)	Mar - May 04 (4 ID)	N/A	Sep - Oct 04
2 ID	2 Engr	29	2 ID/F	4 Qtr 05	1 Qtr 06	2 Qtr 06
2 ID	44 Engr	29	2 ID/F (1) 4 ID/R (28)	2 Qtr 06	3 Qtr 06	4 Qtr 06
3 ID	10 Engr	29	UFR	N/A	1 Qtr 07	2 Qtr 07
3 ID	11 Engr	29	UFR	N/A	2 Qtr 07	4 Qtr 07
3 ID	317 Engr	29	UFR	N/A	4 Qtr 07	1 Qtr 08

What has changed is the availability of certain resident training courses at Fort Benning, Georgia, due to the recent consolidation of MOS 11Ms (mechanized infantryman) and 11Bs (light infantryman). Details on the impact of these changes on our engineer Bradley training strategy and other Bradley news can be found on the Warfighter Web page at *http://www.wood.army.mil/warfighterBradley.htm.*

POC is MAJ Otis Cagle, 37747; DSN -7747; or e-mail *caglee@wood.army.mil.*

Visual Archives. The History Office at the Engineer School is developing a visual archives. It currently has more than 18,000 photographs, largely from World War II and Korea. Units that would like to contribute photographs (copies) or other visual material should contact Dr. Larry D. Roberts, Historian, U.S. Army Engineer School, Fort Leonard Wood, Missouri 65473. Where possible, caption information should accompany the images. If you have questions, please call Dr. Roberts at (573) 563-6109.

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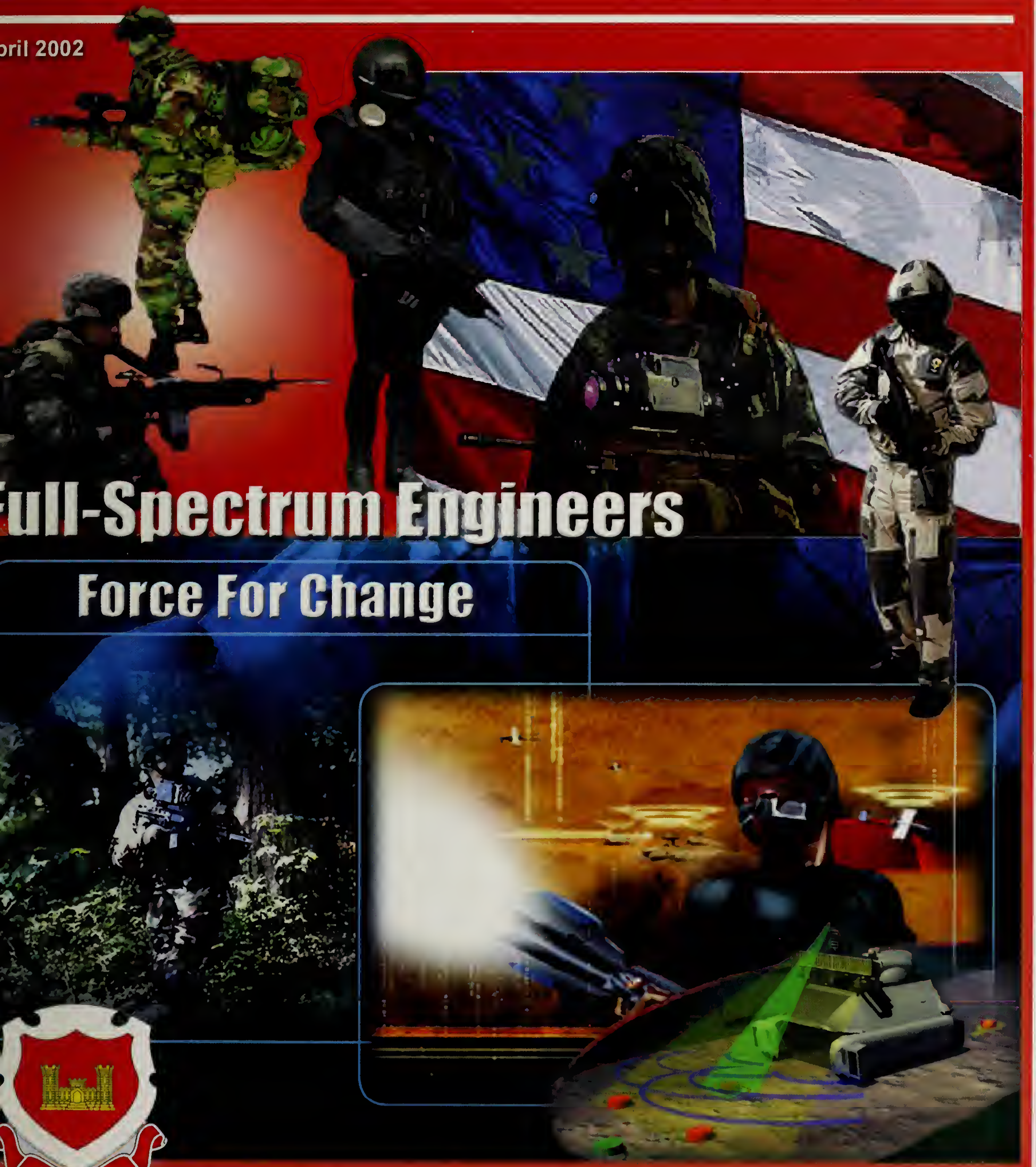

ull-Spectrum Engineers

Force For Change

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U.S. Army Engineer School
573-xxx-xxxx / DSN 676-xxxx

COMMANDANT
MG Anders B. Aadland
563-6158
aadlanda@wood.army.mil

ASSISTANT COMMANDANT
BG Randal R. Castro
563-6192
castror@wood.army.mil

REGIMENTAL COMMAND SERGEANT MAJOR
CSM Robert R. Robinson
563-8060
robinsonr@wood.army.mil

DEPUTY ASSISTANT COMMANDANT
COL John (Pat) Leake
563-8080
leakej@wood.army.mil

DEPUTY ASSISTANT COMMANDANT – USAR
COL Jimmy T. Fox
563-8045
foxj@wood.army.mil

DEPUTY ASSISTANT COMMANDANT – ARNG
LTC Robert Hudnall
563-8046
hudnallr@wood.army.mil

TRADOC SYSTEMS MANAGER for ENGINEER COMBAT SYSTEMS
COL John Holler
563-4081
hollerj@wood.army.mil

TRADOC PROGRAM INTEGRATION OFFICE - TERRAIN DATA
COL David Kingston
563-4086
kingstond@wood.army.mil

COMMANDER, 1st ENGINEER BRIGADE
COL James Rowan
596-0224
rowanj@wood.army.mil

DIRECTOR OF TRAINING
COL Jeffrey LaMoe
563-4093
lamoej@wood.army.mil

DIRECTOR OF ENVIRONMENTAL INTEGRATION
COL Robert S. Kirsch
563-4119
kirschr@wood.army.mil

DEPARTMENT OF INSTRUCTION
LTC Jeff Bedey
563-4129
bedeyj@wood.army.mil

CHIEF OF DOCTRINE
LTC William Duddleston
563-7537
duddlestonw@wood.army.mil

HUMANITARIAN DEMINING TRAINING CENTER/COUNTERMINE TRAINING SUPPORT CENTER
Mr. Paul Arcangeli
596-3869
arcangelip@wood.army.mil

By Order of the Secretary of the Army:
ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:
Joel B. Hudson
JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0129003

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UNITED STATES ARMY
ENGINEER SCHOOL

COMMANDANT
Major General
Anders B. Aadland

MANAGING EDITOR
Lynne Sparks
EDITOR
Shirley Bridges
GRAPHIC DESIGNER
Jennifer Morgan

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***Back Covers:** Future Combat Systems*

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Clear The Way

By Major General Anders B. Aadland
Commandant, U.S. Army Engineer School

FULL-SPECTRUM ENGINEERS – FORCE FOR CHANGE! Excitement is in the air as we near ENFORCE 2002. This will be a tremendous event for our Regiment's leaders; we can't wait to see all of our Engineer warriors gather here and engage in camaraderie and healthy exchanges of ideas and resolve tough Regimental issues. We'll roll up our collective sleeves to get some important work done as we continue to transform our Regiment and Army. Our ENFORCE conference theme, Full-Spectrum Engineers—Force for Change, conveys two vital points about where we are and where we must be. The events of 9-11 underscored the role of the Engineers across the spectrum of conflict—from homeland security (HLS) to global war on terrorists to full-scale, high-intensity warfare. The vast breadth, diversity, and power of our branch continue to be demonstrated by you throughout the world. And the Engineers are at the forefront of the Army's Transformation, not just going along with change but driving it. The ENFORCE 2002 theme captures the excitement of our vitality today and the extraordinary road ahead. The conference agenda is loaded with activities and sessions that will instill pride, recognize excellence in our ranks, address key concerns, stimulate new thought, and break old paradigms. The war stories will abound, as always, as we reacquaint with our sapper compatriots returning to the Home of the Engineers from around the world.

We'll start the week off with our Councils of Engineer Sergeants Major and Colonels. We will continue to update our senior leaders on what's going on at the School, review the status of current issues, some of which resulted from the Commandant's VTC at the end of March, and give a lead-in to the ENFORCE breakout sessions. We have six challenging issues set for this year's breakout sessions: 1) Engineer Command and Control (C2) Systems; 2) Assured Mobility and Future Engineer Organizations; 3) Countermine Operations in the Contemporary Operational Environment (COE); 4) Homeland Security—Engineer Support Requirements; 5) Engineer Officer Education Transformation (OES); and 6) Joint and Field-Force Engineering (FFE). We look forward to your personal contribution in at least one of these vital issues.

The Engineer C2 Systems breakout will review the development of such C2 systems as the Maneuver Control System–Engineer (MCS-E), Force XXI Battle Command Brigade and Below (FBCB2), CastleNET, and Digital Topographic Support System (DTSS). The session will provide a detailed review of existing Engineer C2 systems, their capabilities and shortcomings, and the planned way ahead to make them more valuable tools for Engineers and maneuver forces and ensure full integration of Engineer command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) in current and evolving combined-arms operations.

The Objective Force's mobility is absolutely critical to ensuring that it maintains force agility, freedom to operate in the COE, and high-tempo combat operations over the extent of the battlespace. In the Assured Mobility breakout session, we will discuss how we as a Regiment must understand the concept of Assured Mobility and determine how we can make it a reality for the Objective Force Unit of Action (UA).

In the COE, we no longer face enemies who use mines primarily to shape the terrain; turn, fix, block, and disrupt are no longer the intended payoffs of enemy mine warfare. These have been replaced by the threat's use of mines as a terror and casualty producing system—the perfect asymmetric weapon of the Third World. Though employment techniques are different, mines and booby traps are just as lethal and even harder to detect. This dilemma imposes serious challenges to our maneuver forces today and assured mobility for future forces. In the Countermine breakout session, you will see how your Engineer School is attacking this challenge head-on and developing an organization with the expertise to orchestrate an aggressive, combined-arms, joint effort to provide solutions across the DTLOMS spectrum.

As I stated in the February 2002 Engineer Bulletin, "Combat Engineer doctrine, units, systems, training, tactics, techniques and procedures must address a new threat, a new operational environment here and abroad, and new roles that must fill voids in Army planning." Our Homeland Security breakout session will go into detail on the missions, responsibilities, and requirements of Engineers in their critical role in the defense and preservation of our free and secure homeland.

The OES session will update Engineer leaders on TRADOC's Leader Development Campaign Plan and the Engineer School's role in transforming the Engineer OES. We will discuss the timelines for its implementation and its impacts on the field.

In the Field-Force Engineering breakout session, you will see how FFE is our way of putting General Engineering requirements into the plans for contingency operations and ensuring that critical Engineer resources are available at the time and place necessary to execute each contingency operation. As we develop FFE as a concept, it's easy to see the complexities involved with coordinating the efforts of many diverse organizations; but it's also easy to see the power of the combined efforts of these organizations.

(Continued on page 10)

Lead The Way

By Command Sergeant Major Robert R. Robinson
U.S. Army Engineer School

Our 14th annual ENFORCE conference is fast approaching, and I would like to echo MG Aadland's remarks regarding the importance of this week to our Regiment. I sincerely hope that you are looking forward to spending this week at Fort Leonard Wood, renewing friendships and resolving issues as we focus on our full-spectrum engineering capability in support of our Army, now and in the Objective Force. I also want to address some issues that will shape the focus of the Council of Command Sergeants Major (CSMs) and generate what I am sure will be lively discussion among our senior leaders.

We will kick off the week with 2 full days of Council of CSMs sessions—the agenda is on the ENFORCE Web site. Among our usual topics will be a career-management-field brief from the Engineer Branch, an update from the Directorate of Combat Developments, an Engineer ANCOC/BNCOC course update, a review of our proponent guidance to the DA centralized boards, an update from the Army Engineer Association, and a brief from former FORSCOM CSM, CSM(R) Jerry Alley, on financial planning. Addresses from the Chief of Engineers, LTG Flowers; MG Aadland, Commandant, U.S. Army Engineer School; and BG Castro, Assistant Commandant, U.S. Army Engineer School, will complement our agenda.

We also have SMA Jack Tilley scheduled for a talk on Tuesday. He will spend 2 days at Fort Leonard Wood, attend our ice-breaker social, and be a featured guest speaker in Lincoln Hall auditorium on Wednesday. This is a great opportunity for us to be in the midst of someone who has such a great impact on us and our soldiers. SMA Tilley will share his thoughts and concerns and, I'm sure, will be available to answer your questions.

The remainder of the ENFORCE schedule mirrors the past—vendor displays, Regimental review, barbeque social, Army Engineer Association luncheon, and unit plaque dedications. Culminating the week will be our Regimental run and the dinner, where we will recognize our 2001 Itschner, Sturgis, and Grizzly winners, along with our gold de Fluery medal recipient.

Please arrange your itinerary so you can register on Sunday, participate in all the Council of CSMs schedule and, if desired, stay through Saturday to play in the ENFORCE golf tournament. As always, please bring your colors so we can display them during our Regimental dinner.

Since the last Lead the Way article, I have traveled to several installations. I truly enjoyed visiting with the soldiers of the Regiment and being immersed in the uniqueness of the many organizations and missions we have in our branch. Say I'm biased, but our soldiers are the greatest in the Army. We are blessed with talented officers and noncommissioned officers who competently lead our soldiers through the varied and complex missions our Army expects us to execute.

Along with my firsthand observations, I routinely receive e-mails and calls on the great support and effort our soldiers provide to installations and missions all over the world. Several weeks ago, a retired CSM, who works at a chemical munitions arsenal, called me. He told me that shortly after the events of 11 September, soldiers had been deployed to his arsenal to assist in security. He stated that he was so impressed by the professional bearing and discipline of the soldiers that he approached a few of them to find out what unit they were from. He said he was amazed to learn that they were active-duty engineers assigned to a midwest installation. He called me to tell me what a great job they were doing and that I should be proud (as I always am) of our soldiers.

I am extremely proud of all that you and our soldiers represent. We have a common factor that's evident in all of our organizations: we are all extremely busy and feverishly working to accomplish the missions of our Army and nation. From shaping doctrine and design of our organizational mission and structure to supporting the efforts related to Operations Noble Eagle and Enduring Freedom, engineers are completely integrated and involved.

Our Army needs us as much now as it ever did. If there is ever a doubt as to whether the Regiment will be viable as part of the Objective Force, just look to the past and examine how we have transitioned the Regiment as our Army changed over the last 226 years. There is no question that for as long as there is an Army, there will be engineers.

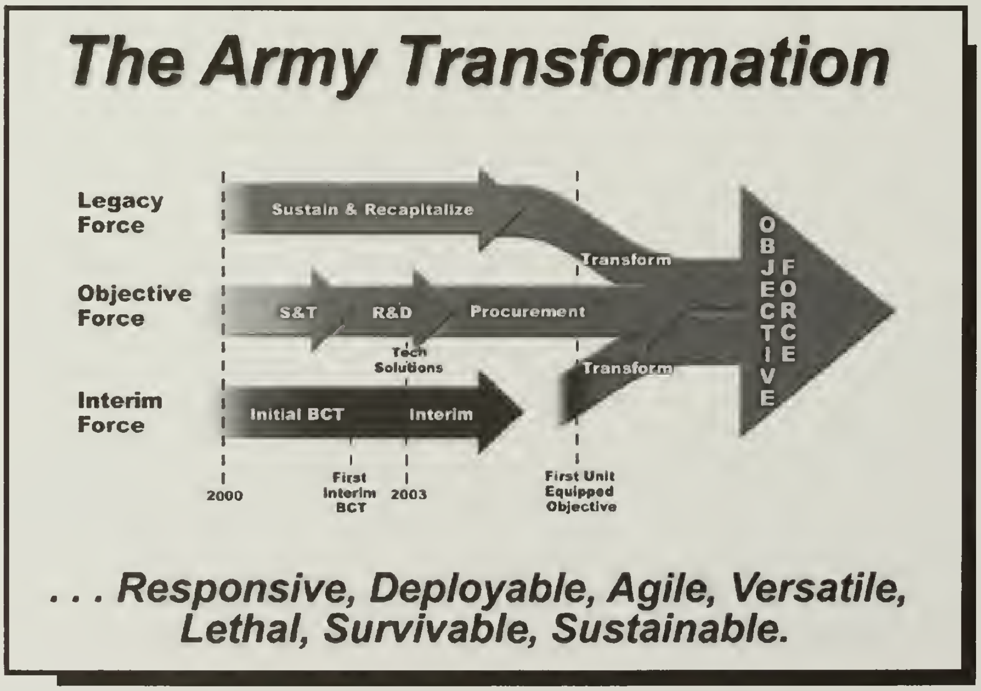
As we move into the remaining months of the year, I will make every effort to visit with you and your units. Being with you and our soldiers gives me an intense sense of pride in all we do for this country, and it makes me grateful for the opportunity to serve as your Regimental CSM.

ESSAYONS—Engineers Lead the Way!

ENGINEER WHITE PAPER – INTO THE OBJECTIVE FORCE

By Major General Anders B. Aadland and Mr. James L. Allen

Engineers are a full-spectrum force for change. During the past year of so, we have all become familiar with the "trident" chart pictured below. It is Chief of Staff of the Army General Eric K. Shinseki's vision of how our Army must transform over the next 30 years. Engineers are fully involved in all three legs of the trident—the Legacy, Interim, and Objective Forces. Our involvement extends from the very tip of the spear all the way back to the sustaining base and includes elements of the soldiers and civilians working in the Active Component, Reserve Component, and Corps of Engineers. No other Regiment has that broad a band of responsibility.


The Army Transformation

. . . Responsive, Deployable, Agile, Versatile, Lethal, Survivable, Sustainable.

In past White Papers, our priority has been the Legacy and Interim legs of the trident. In this paper, our priority shifts to the third leg, the Objective Force.

The Objective Force

As a quick review, let us recall that the Objective Force is to have the deployability of the Interim Force with the lethality and survivability of today's Legacy Force. Beyond that, it will enable us to fight in a whole new way, using total situational overmatch and precision engagement. Built around the Future Combat System (FCS), the Objective Force will also include the Comanche helicopter and the Crusader field artillery cannon. Units will be structured as "units of action" (UA) and "units of employment" (UE). The Army is using these new designations to get us to think about unit organizations other than the platoons, companies, battalions, brigades, divisions, and corps with which we have all grown comfortable. UAs—roughly analogous to today's battalion and brigade combat teams—are tomorrow's maneuver units. UEs—roughly analogous to today's divisions and/or corps—are tomorrow's planners, synchronizers, and supporters.

The force made up of UAs and UEs will be lighter than today's force and easily deployed anywhere in the world within 96 hours. It will have superior firepower, networked together and capable of engaging any threat from beyond the threat's capability to engage us. Situational awareness and understanding of the entire battlefield is *an integral part of its survivability and lethality*. With this information, we stop reacting to obstacles as we encounter them and start making decisions based on the ability, capability, and intent of the enemy to emplace an obstacle. In this way, we are reacting to information, not just obstacles on the ground.

Envision a typical heavy armored division on today's battlefield, a division equivalent perhaps to one of our divisions in Operation Desert Storm. The commander of that division knows where all of his units are located and knows their capabilities. He wants to know where we are located as well. Now, think of us entering the battlefield in about the same strength as today's maneuver brigade. It doesn't seem a very fair fight, but in the Objective Force, we will not only know where all of our units are located, we will have a complete picture of where all of the Republican Guard units are located as well. And, with our precision strike and other capabilities, we will start blinding the threat before we land, taking down his command and control nodes so he loses touch with his own units. Our brigade-sized unit—the UA—will engage each of the threat's units in turn from standoff distances. Because the threat commander no longer has the ability to keep in touch with his own units—let alone target ours—our smaller, lighter force will quickly roll up the much larger unit. The Republican Guard commander may not even know we have landed until we are knocking at the door to his headquarters. That, in a nutshell, is the theory of the Objective Force.

Where does this unparalleled situational understanding come from? It comes from sensors and databases, all networked together and available to the soldier on the ground or as he flies to the battlefield. The Global Information Grid (GIG), an element of the Objective Force, is an integrated, interoperable digital information infrastructure supporting the strategic, operational, and tactical information and intelligence needs for our warfighters. Whatever information we need will be available to us from the GIG. Future improved versions of our Digital Topographic Support System (DTSS) and the Maneuver Control System (MCS) will feed information into, and receive information from, the GIG. Data from the intelligence community, national intelligence assets, and other military and civilian information providers will also be fed into the GIG, fused at some point and fed back on demand. We may receive digital geospatial information and imagery in the middle of an Asian jungle from a French, Russian, or even a commercial satellite.

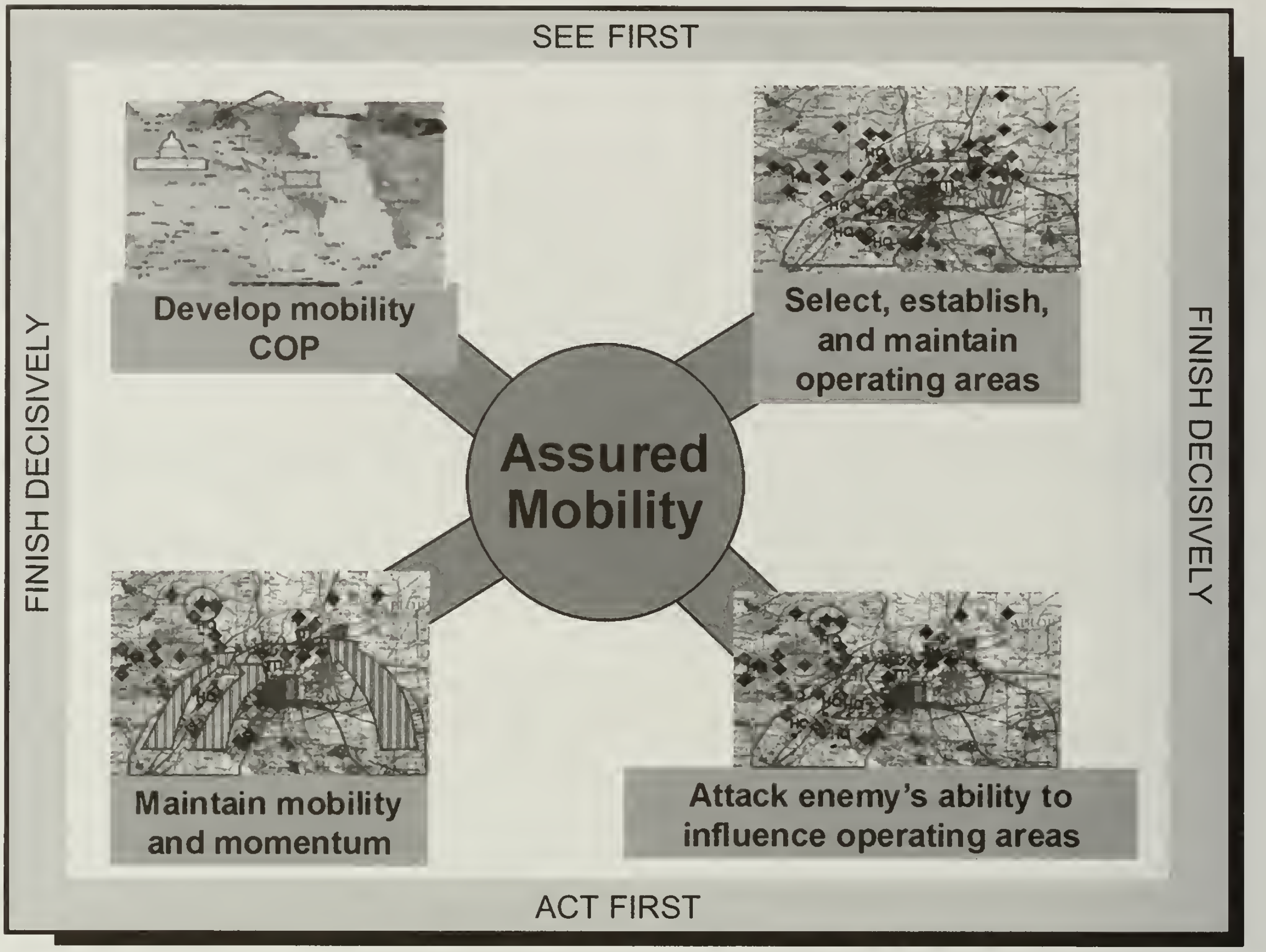
Organizational structures are still being designed, but current UA designs have engineers embedded within the UA itself, as if today's tank battalion had its own organic engineer platoon. Many engineer "capabilities" will be performed by nonengineer personnel or organizations and may be built into equipment designs (for example, blast mitigating hulls on the FCS). There will be extensive use of robotic systems to perform the dangerous missions of countermine and reconnaissance, to name only two.

UE organizations are still being designed. It is our intent for engineer UE organizations to be modular offspring of today's echelon-above-division (EAD) and echelon-above-corps (EAC) battalion-sized organizations, existing within the UE to support the UA. Some of these modules will be specialized teams. These engineers will be supporting not only U.S. forces but also coalition forces and other governmental and nongovernmental organizations and will be needed to restore facilities to the local population and government. Special "urban infrastructure" organizations and technical or specialized augmentation support teams/cells are likely to be needed for such things as power generation and distribution, sanitary sewers, and water- and gas-distribution nets, in addition to execution of environmental baseline surveys and integration actions. Contractors will most likely provide a good deal of this support.

New Objective Force Tasks

Our work with the Objective Force has already introduced a new concept—assured mobility. Today, our forces avoid obstacles when possible and breach them when necessary, but tend to react to minefields and other obstacles as they approach them. Assured mobility is a combined-arms proactive approach to mobility in which we use information to maximize avoidance and prevent enemy actions that inhibit mobility. Computer algorithms are used along with intelligence, geospatial information, and weather data to identify numerous routes to the objective and to predict likely obstacles along each of those routes. The task force then maneuvers along multiple, dispersed, parallel routes to the objective. In this manner, minefields are no longer as prevalent, and we can handle them at standoff without changing our momentum. The slow, methodical breaching of minefields that we must practice today becomes the exception rather than the rule. This is how it works:

- **See First**—We develop the mobility common operating picture (COP) by integrating terrain, imagery, and intelligence to determine potential operating areas.
- **Understand First**—We select, establish, and maintain operating areas by identifying or predicting potential obstacles and booby traps, enemy staging areas, threat avenues of approach and egress, and emplacement methods using standoff detection means. We then "swarm" surveillance assets to cover suspected areas. Sensor nets allow us to detect enemy movements and actions, which cues validation sensors to suspected activity. The sensors then track the enemy and provide a detailed COP to our engagement systems.
- **Act First**—We swarm surveillance assets to attack the enemy's ability to influence our operating areas before he has a chance to place mines into or onto the ground,


SEE FIRST
Develop mobility COP
Select, establish, and maintain operating areas
Assured Mobility
FINISH DECISIVELY
FINISH DECISIVELY
Maintain mobility and momentum
Attack enemy's ability to influence operating areas
ACT FIRST

and we neutralize any overwatching observation and fires in order to deal with mines or booby traps out of contact.

- **Finish Decisively**—The cumulative effect of *See First, Understand First*, and *Act First* allows us to mass forces arriving on multiple routes to *Finish Decisively.* Mobility actions such as breaching and bridging are included.

Objective Force 1-n List

1. Mobility Information System
2. Standoff Mine Detection
3. Standoff Mine Neutralization
4. Brilliant Sensor-Munition
5. FCS-Mobility Variant
6. Maneuver Support Bridging Suite
7. Rapidly Deployable Construction Equipment
8. Terrain Shaping Munition
9. Demolition Modernization
10. Infrastructure Construction Equipment

With this shift in emphasis, we have also changed our priority for materiel development. Three tailored lists have replaced the single "1-n" list you have seen in the past, one for each of the three forces.

The Interim Force

We are more familiar with the Interim Force. Like the Objective Force, the CSA's intent is to put a combat-capable brigade anywhere in the world within 96 hours, a full division in 120 hours, and five divisions on the ground within 30 days. The Interim Brigade Combat Team (IBCT) has a 118-man sapper company that supports 80 percent of the mobility tasks[1] required for the IBCT and has specialized engineer equipment, including an engineer variant of the Stryker interim armored vehicle, the Rapidly Emplaced Bridge System (REBS), the Volcano scatterable mine system, the small emplacement excavator (SEE), (which will be replaced by the high-mobility engineer excavator [HMEE]), a downsized version of the Mongoose explosive standoff minefield breacher, the deployable universal combat earthmover (DEUCE), and access to the Digital Topographic Support System (DTSS) which is located at the brigade headquarters. The Engineer Regiment in the Interim Division (IDIV) provides the maneuver commander with engineer command and control, mobility (to include assault bridging with the REBS), countermobility, survivability, general engineering (both vertical and horizontal construction), and embedded geospatial engineering support. EAD engineer support augments the capabilities of both the IBCT and IDIV engineer organizations.

We have developed a separate 1-n list specifically for this force. There are a number of differences between this list and the one for the Objective Force; these differences reflect the differences in the missions of the two forces and the time frame of their availablility. The IBCT/IDIV engineer equipment and concepts must be proven out for use in the Objective Force.

Interim Force 1-n List

1. DTSS (five variants)
2. Engineer Squad Vehicle
3. Standoff Mine Detection
4. Mongoose
5. REBS
6. Countermine Robotics
7. Raptor/ Advanced Hornet
8. Demolitions Modernization
9. HMEE
10. Light Construction Suite
11. Bridging Suite
12. MCS-E
13. Volcano/APLA

The Legacy Force

The Legacy Force provides our near-term offensive capability. It contains a light "forced-entry" force that includes the 101st Airborne Division (Air Assault), 82d Airborne Division, 10th Mountain Division, 25th Light Infantry Division, and the National Guard's 29th Light Infantry Division. The Legacy Force includes an "early-entry" force (referred to as the containment force in some documents) composed of forward-deployed divisions (1st Infantry Division, 2d Infantry Division, and 1st Armored Division) and active and Army Reserve reinforcing combat units along with seven National Guard divisions and eight National Guard enhanced brigades. These forces will undergo only modest modernization efforts, sustainment, and recapitalized to maintain our offensive power until the Objective Force is fielded. They will be among the first units to move to the Objective Force. The "heavy-punch" component of the Legacy Force is the modernized III Corps, maximized for a counterattack role and composed of 1st Cavalry Division, 4th Infantry Division, 3d Infantry Division, and 3d Armored Cavalry Regiment. The Counterattack Corps is the Army's highest priority for reorganization. With the Army's decision to not procure the Grizzly, our #1 priority system last year, the Legacy 1-n List is changed as follows:

Legacy Force 1-n List

1. Wolverine
2. Standoff Mine Detection (HSTAMIDS, GSTAMIDS, and ASTAMIDS)
3. DTSS
4. MCS-E
5. Hornet/Raptor
6. Bradley Engineer Squad Vehicle
7. Mongoose
8. Bridging Suite (common bridge transporter [CBT], improved ribbon bridge [IRB], dry support bridge, and line-of-communication bridge [LOCB])
9. Countermine Robotics
10. Construction Equipment

Headquarters, Department of the Army has directed only modest modernization in this force, accepting risk here to enable development of the Interim and Objective Forces.

Near-Term Work Effort

EAD and EAC Engineer Battalions

Our quest for change does not ignore the EAD/EAC portion of our Regiment. A review of these organizations can streamline certain components into the more mobile and deployable units we need in the future. This portion of our force structure comprises 72 percent of our Regiment and is a major player in our plans for the Objective Force. What this force brings to the fight is the ability for long-term sustainment of operations. However, we must begin to upgrade our construction equipment fleet, for which we need approximately $150 million per year. We have been working with less than that requirement for years. We must take a hard look at the capabilities we need, eliminate redundancy, and develop alternatives to provide our construction needs. Key missions into the Objective Force will include airfield construction and improvement, lines-of-communication (LOC) development and maintenance, infrastructure development and sustainment, and mine-clearing operations and environmental-integration actions.

Restrictive/Complex Terrain

As the Russians learned in Chechnya, and as we learned in Mogadishu, military operations in urban terrain (MOUT) remain the great equalizer. We must prepare and equip our soldiers now for these highly likely future scenarios. We must give our platoon and company officers the tools, experience, and tactical acumen to fight and win the MOUT battle. The Infantry School has the lead in development of MOUT doctrine and training strategy, and we will be in "lockstep" with them as we identify the doctrine, training, leader development, organization, materiel, and soldier (DTLOMS) requirements for the combined-arms team at brigade level and below. We see our traditional engineer MOUT missions of rubble, mine, and booby trap clearing; demolitions; force protection—to include environmental considerations, survivability, and infrastructure repair—continuing into the Objective Force.

Beyond MOUT, engineers will continue to add great value to the force when it encounters difficult terrain. Our force-modernization plan is sharply focused on enabling high mobility of the transformed Army and on emplacing dynamic obstacles for countermobility operations. Geospatial engineering promises detailed terrain-feature information about roads, airfields, buildings, bridges, obstacles, subsurface infrastructure (for example, storm sewers and utility conduits), and anything that has a symbol on the map. "Point-and-click" technology will bring up an information table (attributes) about each symbol and provide key information upon which tactical decisions will be based. Predictive terrain modeling for both threat analysis and friendly course-of-action development is required. Key programs in the works are—

- Rapid acquisition and application of fully attributed digital terrain data to support three-dimensional terrain visualization.
- Decision support tools that provide predictive modeling of building composition and strength of materials for precise and proportional weapons effects.
- New explosive and nonexplosive technologies for standoff/remote reduction of walls and other obstacles. We are the obstacle-reduction experts and must be fully knowledgeable of the latest in explosive and nonexplosive technologies. To this end, we are establishing a "master breacher" program similar to the armor and infantry "master gunner" programs.
- Modifications to our training methods that ensure we have the necessary skills to meet the challenges of fighting and winning in complex terrain.
- Employment of robotics to support the full spectrum of MOUT—from robotic followers used as "mules" that can transport equipment and casualties to robots used in reconnaissance and clearing/breaching operations to create lanes through obstacles.
- The need for urban rubble-clearing capabilities to maintain maneuver dominance in complex terrain.
- The need to reinforce, rebuild, or reestablish civilian infrastructure.
- The need for our sappers to move, shoot, communicate, and pave the way for the maneuver force they support. Sappers must have the tools, TTP, and training needed to accomplish their mission for the combined-arms team.

Geospatial Engineering. This is the development, dissemination, and analysis of terrain information that is accurately referenced to precise locations on the earth's surface. Although this is new terminology (replacing topography), the emphasis is still on engineers being the terrain experts for the maneuver commander. Our leaders must be "masters of terrain." Geospatial engineering is keeping pace with other Department of Defense organizations and services as they move from the old topographic line-map mentality into a new geospatial information age. The National Imagery and Mapping Agency (NIMA) has developed the foundation-data concept, a revolutionary approach to provide geospatial information to warfighters. It relies on a readiness and responsiveness strategy that moves away from many standard products and toward an information-management environment. This strategy calls for the establishment of near-global coverage of foundation data, including medium-resolution geospatial information (for example, a joint-operations graphic at 1:250,000 scale). Regardless of location or mission, the foundation data will be available and maintained to provide a consistent, worldwide level of preparedness or readiness. Enhancements to the foundation data will generate mission-specific data sets to satisfy specific mission information needs. The mission-specific data sets are more detailed than foundation data and contain more time-sensitive geospatial content to meet intended uses. Engineer leaders must know how to exploit this information.

Countermine. Currently, at least 72 countries have mines already in the ground, impacting all CINC areas of responsibility. To most Third World countries, mines are a cheap, nasty, and effective means of conducting asymmetric warfare against a First World state and protecting national or tribal interests. Mines remain the "weapon of choice" for many rogue states. The article on page 21 describes how the Engineer School is tackling the countermine requirements for the current and the future force.

Dynamic-Obstacle Emplacement. The offensive and dynamic nature of future operations, coupled with the reduced number of sappers on the ground, forces us to shift from a reliance on conventional obstacles to emplacement of less-manpower-intensive dynamic obstacles with "turn-on/turn-off" and programmable self-destruct capability.

Fratricide from scatterable mines, time and resources required to put up fratricide fences, and implications of short-duration scatterable mines—coupled with problems associated with long-duration release authority—dictate that we look for a turn-on/turn-off capability. We must also look at "self-reporting," "self-marking," and Force XXI Battle Command-Brigade and Below (FBCB2) reporting capabilities to further enhance the task force's situational awareness. We are exploring, with other proponents, possible solutions to emplacing deep dynamic obstacles.

Munitions such as the Hornet, Advanced Hornet, Raptor Intelligent Combat Outpost, and mixed (antitank and antipersonnel) Antipersonnel Landmine Alternatives (APLAs) will provide us with new capabilities incorporating a high-tech ability to seek, identify, and destroy enemy ground vehicular systems. The Advanced Hornet will give us the first remote turn-on/turn-off capability and provide technological insights to add this capability to our current stock of scatterable mines. These intelligent dynamic-obstacle systems seamlessly integrate with our overarching engineer geospatial and command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) MCS.

Alternatives to current "dumb" antipersonnel land mines are being developed. Among these alternatives are an artillery-delivered mixed munition; a "self-healing" minefield consisting of antitank mines equipped with sensors, internal communication systems, and injectors that relocate and synchronize the minefield in near real-time; and non-self-destructing alternative (NSDA) munitions that add a soldier to the decision loop before munition activation.

C4ISR Systems. As we look at the Army's Transformation Campaign Plan—our path to the future—we see that knowledge-based battle command is the key to increased lethality and survivability. Comprehensive and reliable C4ISR systems are the cornerstone of the digitized Army. They give us the COP and superior situational awareness and understanding to facilitate precision maneuver and engagement.

One of our most important near-term goals is to define the critical information that must be digitized and how it is to be managed. It is critical that we work with our field commanders to correctly define this requirement. To maintain our relevance on the battlefield, we must develop and field a world-class engineer MCS. The MCS-E is an automated decision support and management element to be embedded in MCSs supporting the maneuver commander and providing the engineer commander rapid answers otherwise requiring time-consuming, manual calculations. The MCS-E is tied to the DTSS and the rest of the Army Battle Command System (ABCS) and is fully integrated throughout the battlespace. It links the commander to Tele-Engineering assets providing access to subject-matter experts from around the world.

Changes in engineer command and control structures in EAD are also being defined. Problems dealing with a mix of digitized and nondigitized units are prevalent. As LOCs become extended and the security of these LOCs decreases, command and control becomes more challenging. A near-term requirement will be defining the roles of engineer brigades and groups and their span of control in the battlespace.

Training, Leader Development, and Soldiers. The explosion of information technology, with its attendant operational and personnel implications, is helping to forge the Engineer Regiment of the 21st century. Even with changes to our structure, equipment, and technologies, our core functions of battlefield engineering and infrastructure support remain central to our mission. The Regiment must acquire the finest equipment and write the doctrine for using it effectively on the battlefield. The Regiment must also develop soldiers and leaders with the right skills, knowledge, and experience to meet unforeseen challenges of the 21st century. In the end, our most important mission and future success lies with the soldiers we train, equip, and deploy in support of the Army and the nation. Army training is in a period of significant transition. What we train, how we train, and the methods used to plan and execute training are all changing.

The article on page 24 describes how the legacy Officer Education System (OES) will transform to meet the Objective Force education needs. These changes are required due to the diversity of the Army's missions, the scarcity of resources, increased weapon lethality, and an anticipated decrease in available training time and space. The purpose of the next few paragraphs is to provide the direction regimental training will take in the near term.

Digitization is the near-term technology for storing and processing information. In the very near future, there will be fewer hard-copy field manuals, soldier training publications, mission training plans, and such. Access to these training and doctrinal materials comes through the Army Doctrine and Training Digital Library on the Internet or through the Standard Army Training System (SATS). Staffing of proposed revisions occurs electronically. Training development is also transitioning to electronic media. There will no longer be paper-based programs of instruction, lesson plans, and job and task analyses. The training-development process will be accomplished in the Automated Systems Approach to Training (ASAT) database. Training developers input information into ASAT, the data are manipulated, and the output is training products that soldiers/units/activities obtain via an electronic medium (Internet, SATS, or data discs).

Classroom XXI takes the classroom to the battlefield and the battlefield to the classroom. It provides worldwide access to digital information, training, and simulation. We currently have 13 classrooms with this capability and will have 27 by 2009. These classrooms provide a multimedia environment with worldwide access to instruction/information. The digital format of training materials/products provides a faster, more economic means of delivery. In the near term, the Engineer School conducts small-group instruction using expert observer-controllers from the combat training centers, assesses student comprehension and performance, and delivers world-class source materials on demand—to include the capability to televise live classroom instruction to students worldwide.

Distance learning is a concept for delivering training to soldiers when and where it is needed without having to bring the soldiers to the schoolhouse. It is the engine making Classroom XXI achievable; it incorporates a number of emerging technologies to accomplish "distributed learning." CD-ROM and computer-based (Web-based) multimedia programs are two technologies used by the Engineer School. Some training-support packages and portions of some courses are available via these media. The Engineer Focused Battle Command/Staff Training (EFBCST) System is an Engineer School initiative consisting of three progressive training tools for commanders and staffs: the Engineer Battle Staff Training System (EBSTS), Engineer Staff–Conduct-of-Fire Trainer (ES-COFT), and Engineer Collective Command and Staff Trainer (ECCST). The EBSTS is an Internet-based series of courses designed to train commanders and staffs on critical individual tasks. Eight individual position lessons have been developed or are under development. We are continuing to pursue funding for the remaining parts of this training system. Distance learning will be applied in many ways to achieve TRADOC's goal to have soldiers/students spend less time in resident instruction at the school; major portions of courses will be accomplished via distance learning.

Simulators and simulations (Sim2) are in great demand for accomplishing training. Increases in operating tempo and ammunition costs are coupled with a decline in maneuver areas and ranges. Currently, the Engineer School uses constructive simulations (Janus and Brigade/Battalion Battle Simulation [BBS]) to conduct training exercises for leader courses (officer and senior noncommissioned officer). In the next few years, Janus and BBS will be replaced with One-Semiautomated Forces (One-SAF), providing more realistic training possibilities. The training strategy for the Wolverine relies heavily on Sim2 for both institutional and collective/sustainment training. We are working hard to become an active player in the virtual training world. The Engineer School is working with TRADOC on the justification and requirements to include engineer equipment and systems in the close combat tactical trainer/virtual training arena. Our edition of this effort is called the Engineer Combined Arms Tactical Trainer (ENCATT). Pending funding, we project having this capability for the engineer force by the 2005 time frame. Simulations continue to become increasingly realistic and eventually will include simulations of individual soldiers connected via fiber-optic/distributed interactive simulation lines all over the world.

Tactics, techniques, and procedures and new doctrine will be developed for engineer soldiers and leaders with new equipment and concepts to support the Interim and Objective Forces.

Conclusion

Development of new engineer capabilities is not solely the job of the schoolhouse. Good solutions require the help of the entire Engineer Regiment. I challenge the combat developments community, school, labs, and engineer commanders in the field to focus on the issues presented throughout this paper. By focusing our efforts on these top issues, we will be able to achieve our goal—*to remain the best-trained, -prepared, and -equipped engineer force in the world.*

Major General Aadland is the Commandant of the U.S. Army Engineer School and Commander of the Maneuver Support Center, Fort Leonard Wood, Missouri.

Mr. Allen is the lead analyst and science advisor for the Concepts Branch, Engineer Division, MANSCEN DCD. He is retired from the U.S. Army Reserve with 34 years of active, reserve, and civilian military duty.

Endnote:

[1] The company's limited countermobility and survivability capabilities, and no general engineering capability, make it dependent on other engineer units for this support.

("Clear The Way," continued from page 2)

We have spanned the Army in our search for ENFORCE guest speakers who are relevant to the Army's change and operationally centered to give you the straight facts, insights, and vision that you need to hear and challenge. These speakers agreed to come because they understand the importance of Engineers to our Army now and in the Objective Force. If you have an important message to convey to the conference from your neck of the woods, let me know and we'll help get your story out.

With much help from Engineers in the field and our SOF, Infantry, Armor, MI, and Ordnance brothers-in-arms, the Engineer School continues to make progress developing solutions to counter our current and future mine and booby-trap problems. Since briefing the Vice Chief of Staff of the Army (VCSA) and the Army Requirements Oversight Council (AROC) last December, we have continued to move forward in efforts to get our deployed forces in Operation Enduring Freedom (OEF) what they need now to detect and neutralize mine threats. In conjunction with HQ TRADOC, we established a Countermine Integrated Concepts Team (ICT), that launched a Countermine Council of Colonels (CoC), which met in March, and a Countermine General Officer Steering Committee (GOSC), which met in April. These fora had great participation from the DA staff, other branch proponents, our sister services, national agencies and labs, and the intelligence community. This continues a full-court press effort to solve current and future countermine challenges and ensure that the countermine priority is not just another "flash in the pan." We are planning future CoC and GOSC meetings, will seek your participation, and will keep this program at the forefront of Army priorities.

The pace of change in our Army and our Regiment are unprecedented. As our CSA, Gen Shinseki, said, "If you dislike change, you're going to dislike irrelevance even more." As a branch, we are committed not only to leading change but also to making sure these changes strengthen the Army's warfighting capability and increase the vitality of our Regiment as a combat arm. With your help, the Engineers will continue to be a force driving change; be sure to keep your head in that game. Enjoy this ENFORCE conference and come ready to participate. Through it you will gain important insights as to where our Regiment can go armed with the commitment, brilliance, and innovation of our current leaders and those bright young sapper leaders who will follow. These are exciting times and we have much work to do!

ESSAYONS!

Assured Mobility
The Path to the Future

By Mr. Mike Fowler and Lieutenant Colonel Gary Johnston

During the past decade, the U.S. Army has been engaged in a deliberate and sweeping effort to adapt its organizations, soldiers, equipment, and methods of operation to the requirements of a rapidly changing strategic and technological landscape. The Army Vision describes the characteristics of the Objective Force, and emerging technologies promise a clear path to that future. The power of advanced technologies, especially information technology, enables the Army to achieve situational dominance and decision-making momentum to create a new construct for the application of force.

The hallmark of the Objective Force described in this article is its reliance on small, lethal, tactical units. At the heart of these units are soldiers and leaders—warriors—who know and live Army values; are disciplined, physically tough, and mentally conditioned for combat; have perseverance; are technically and tactically competent; and possess an unbreakable will to win. These tough, resilient, resourceful, versatile professionals—equipped with the best technologies our nation can provide and led by the most competent leadership we can grow—will remain persuasive in peace and invincible in war, the ultimate guarantors of America's interests around the world.

Operational Concept

The Objective Force is a full-spectrum force—organized, manned, equipped, and trained to be more strategically responsive, deployable, agile, versatile, lethal, survivable, and sustainable across the entire spectrum of military operations. Objective Force units contribute to decisive joint operations by conducting simultaneous, distributed, continuous, combined-arms air-ground operations—day or night—in any terrain throughout the battlespace.

Objective Force units are designed to operate at a tempo that affords the enemy no rest or relief and no means of responding effectively. These units develop situations out of contact, maneuver to positions of advantage, engage enemy forces beyond the range of their weapons, and destroy them with precision fires and, when necessary, by tactical assault at times and places of our choosing. Objective Force units will employ the full range of national and joint capabilities to *see first, understand first, act first,* and *finish decisively* at the strategic, operational, and tactical levels.

See First

Objective Force units see first by detecting, identifying, and tracking the individual components of enemy units. Advanced technologies that lead to unprecedented intelligence, surveillance, and reconnaissance capabilities—coupled with other ground, air, and space sensors networked into a common integrated operational picture—enable us to see the enemy, both in whole and in part, as a complex, adaptive organization. The enablers for seeing first include, as a minimum—

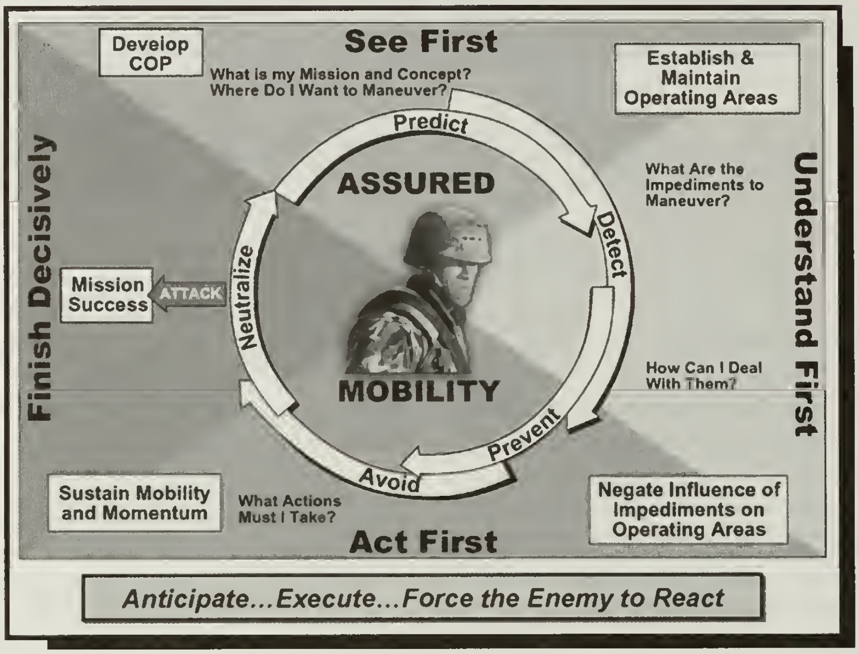
- Combat identification systems.
- Organic sensors that are robotic, multispectral, and disposable.
- Unmanned aerial vehicles (UAVs).
- Embedded command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR).
- Special-operations forces.
- Long-range surveillance detachments.
- Air and ground reconnaissance operations.

Data-fusion systems, global-information grids, and leader training will enable decision makers to have a synthesized, common picture of the battlefield—the common operational picture (COP). Blinding the enemy through the use of obscurants, jamming, signature reduction, deception, and pattern-avoidance techniques will further enhance the Objective Force's ability to see first.

Understand First

Objective Force units understand first through exploitation of a COP of the battlespace that allows soldiers and leaders to understand what the enemy is doing and better anticipate his intentions. As leaders at all levels observe this common picture, they simultaneously analyze and share assessments through their Web-based command and control systems. Objective Force commanders can leverage the intellect, experience, and tactical intuition of leaders at multiple levels to identify enemy centers of gravity and conceptualize solutions, thus creating a collective genius through accelerated collaborative planning within Objective Force units. As commanders decide on a course of action, they instantaneously disseminate their intent to all levels, affording maximum time for subordinate levels to conduct requisite troop-leading procedures. The time gained through effective use of these information technologies enables Objective Force units to seize and retain the initiative and build momentum for decisive outcomes. The key enablers for understanding first include—

- A knowledge-based battle-command system.
- Mentally agile, intuitive, and adaptive leaders at all levels.
- An execution-centric command and control system.


Develop COP
See First
What is my Mission and Concept?
Where Do I Want to Maneuver?
Establish & Maintain Operating Areas
Predict
ASSURED
What Are the Impediments to Maneuver?
Detect
Understand First
Finish Decisively
Mission Success
ATTACK
Neutralize
How Can I Deal With Them?
MOBILITY
Prevent
Avoid
Sustain Mobility and Momentum
What Actions Must I Take?
Act First
Negate Influence of Impediments on Operating Areas
Anticipate...Execute...Force the Enemy to React

Leaders must be educated for rapid synthesis of information, intuitive assessments of situations, and rapid conceptualization of friendly courses of action. They must be able to clearly define their information requirements and, most importantly, develop and effectively communicate their intent. Units must be highly trained and disciplined in the use of these information technologies to efficiently manage the volumes of information they will provide. This will require disciplined use of information protocols, leader education, and new training and leader-development concepts in both live and constructive environments.

Act First

Objective Force units act first by virtue of the superior situational awareness that permits them to engage the enemy at times and places of our choosing. Wide dissemination of the commander's intent, coupled with broad access to the COP, will provide unprecedented opportunities for subordinate initiative to exploit enemy vulnerabilities as opportunities present themselves. Furthermore, this information will allow our commanders to integrate the elements of combat power into a dominant whole when applying decisive force, both lethal and nonlethal. To act first, Objective Force leaders, platforms, and units must—

- Have information dominance.
- Be capable of moving, shooting, and reengaging faster than the enemy.

Target-acquisition systems will see farther than the enemy in all conditions and environments. Units will be able to rapidly assess options, act first by understanding when and where they must transition between actions, and maintain fully synchronous fires throughout the violence of execution. The design is to deny the enemy any respite or initiative while Objective Forces operate at high operational tempo. Objective Force units will be enabled by systems that link and clear line-of-sight and beyond-line-of-sight fires through advanced weapons control systems and man-in-the-loop decision making.

Finish Decisively

Objective Force units finish decisively by destroying the enemy's ability to continue the fight and achieving moral dominance over him. The units will do this by building momentum and rapidly transitioning to assault and exploitation operations without allowing the enemy time or opportunity to regroup and continue the fight. Units will maneuver by both ground and air to assume tactical and operational positions of advantage through which they will continue to dominate the enemy and pursue subsequent campaign objectives. Objective Force units will continue to exploit the initiative until they have broken the enemy morally and/or physically, thus achieving decisive victory.

Assured Mobility

The mobility of the Objective Force is critical to maintain the high tempo and operate over the extended distances dictated by this concept. Assured mobility is one of several key maneuver support enablers of the Objective Force and must be developed to its full potential. Assured mobility extends the concept of air corridor suppression of enemy air defense (SEAD) to ground mobility routes, corridors, or operating areas. Today, troops on the ground must continue to develop the current situation, develop the mobility plan after deployment, and remember that situational understanding is time-sensitive.

In the Objective Force, space, air, and ground imaging sensors will maintain current, real-time situational understanding, and sensor-effects links will preclude the enemy from modifying the current situation. The selected course of action will be encompassed by a blanket of sensor coverage allowing assured mobility with sensors and effects similar to the SEAD effects today. The current operational pictures will be fed continuously to commanders, and area-denial systems will prevent enemy alteration. Future requirements for the intelligence, surveillance, and reconnaissance system include sensors that can distinguish among friendly, enemy, and civilian activities; predict and verify enemy intent with assured route mobility sensors (a mobility decision aid); and deny enemy forces the opportunity to apply countermobility measures.

At present, engineers are task-organized to handle a myriad of tasks in a worst-case mission scenario. Current doctrine requires 150 percent redundancy of engineer systems to ensure mission accomplishment. In the Objective Force, engineers will task-organize only with necessary mission-specific equipment. Mobility support will be provided by planned/focused engineer effort, thereby reducing the necessity of redundancy required today, supported by Future Combat System (FCS) mobility mission modules with prepackaged equipment for specific missions. Future mine-detection and -neutralization capabilities, both standoff and organic, will allow the preparation of the battlefield with an assurance and safety factor not imaginable today. Future requirements include the FCS mobility package, robotic standoff mine-detection and breaching capabilities, and a standoff marking system. Standoff detection and breaching can be accomplished by systems such as the conceptual route access and proofing system, which will have robotic vehicles move down a desired route—identifying and electronically marking mines along the way—with standoff mine killers such as the UAV or vehicle-mounted rockets homing in on the electronic signal to destroy the threat.

There are four main tasks for assured mobility. Those tasks are not necessarily sequential.

Develop the Mobility COP

This is the collection and integration of geospatial, cultural, and enemy information—aided by automated mobility planning tools—to establish the mobility COP for the operating area. This information allows us to quickly develop our initial modified combined-obstacle overlay (MCOO) and enables the maneuver commander to select the mobility course of action. Knowledge of the existing obstacles and monitoring of existing traffic patterns are two examples that allow us to see the battlefield in near-real time. This information allows the maneuver commander to determine where he wants to maneuver, what resources will be required to get there, and how the enemy can attempt to influence this maneuver plan. The mobility COP identifies the operating areas and the mobility issues within those areas for the maneuver plan.

Select, Establish, and Maintain Operating Areas

With the aide of automated tools, critical mobility choke points and operating areas will be identified and a shaping plan developed. This plan includes prediction of enemy actions and intents and required sensor coverage to fill any information voids within the operating area. Sensors will be employed, or focused from other assets, on the critical areas to fill the voids or improve our situational understanding and maintain our mobility COP. To solidify the mobility COP, sensor-effects packages will be employed at critical areas to protect them from enemy influence. In coordination with these sensor-effects packages, conducting standoff attacks on selected enemy capabilities to perform countermine activities—or deceiving the enemy to focus his attention on other areas—will fix the current mobility situational understanding. An active protective system will be emplaced at choke points, such as bridges, to counter enemy attempts to disrupt us at such points. Being able to control and monitor critical mobility areas is key to coordinating a mobility plan in conjunction with the scheme of maneuver. Simply put, "sensor staring" will enable the Objective Force to "own" the operating area.

Attack the Enemy's Ability to Influence Operating Areas

Employing standoff-detection and obstacle-neutralization systems to maintain mobility within operating areas will ensure freedom of maneuver. This will be accomplished with a combination of *unit-of-employment* (UE) and *unit-of-action* (UA) resources. Battlespace terrain reasoning and awareness (BTRA) will allow us to template potential obstacles and locations of where the enemy might place obstacles. Standoff detection of obstacles and standoff neutralization (where necessary) or attacking of these obstacles in coordination with the maneuver plan are critical to reserve UA resources. This is a proactive attack of the enemy's ability to employ obstacles. Attacking the enemy's ability to shape the battle-space is also a key enabler for the UA's mobility. Sensor systems such as the Raptor and the antipersonnel land mine alternative (APLA) will protect the flanks of our units and deny the enemy the freedom of action within our operating area.

Maintain Mobility and Momentum

This allows the UA the freedom of maneuver to seize his objective without delay. Detecting obstacles (including side-attack and wide-area mines) and neutralizing their effects without affecting the maneuver plan or momentum are critical to accomplish the speed and agility required for the Objective Force. As a last resort, an in-stride breaching capability must exist to overcome enemy obstacles that may be encountered when it is necessary for the force to cross. Marking systems that provide visual, virtual, and active identification of obstacles and cleared or safe areas are required. In addition to supporting the assaulting force, maintaining mobility and momentum has a role to ensure that the force can be supported. This includes maintaining and opening routes for pulse logistics as well as forward landing areas for air resupply. We must be able to neutralize the effects of obstacles without disruption of our maneuver momentum in one of four ways: detect and avoid, detect and destroy from standoff, detect and breach, or withstand the effects.

Organizations

To implement the Objective Force concepts, all Army organizations will be analyzed as to their need and relevance. This is especially true for the Engineer Regiment with the wide range of capabilities it brings to the Army. Most Army tasks that are conducted today will remain valid; however, the method used to accomplish those tasks may drastically change. This leads to a complete review of how our units are organized.

There are several considerations that must be applied in developing the future engineer organization. Basic options that must be reviewed are—

- Modularity.
- Tailorability.
- Combined arms to the lowest levels.
- Task organizing on the move.
- Force pooling of engineer capabilities.
- The way we equip and deploy.

Before the engineer units can be developed, the Objective Force organization concept must first be understood. The Objective Force must fulfill a variety of strategic, operational, and tactical purposes, while interacting with various political and military actors within the U.S. interagency process and the international community. Thus, the Army must maintain some mix of functional competencies at all levels. Early analysis indicates that eliminating echelons and flattening hierarchies will not be as easy as commonly perceived. Many factors must be addressed, including the challenges of span of control, the increasing complexity of operations at each level of effort, the expanding battlespace geometry, the differences in tasks and purposes that occur at each echelon, and the human capabilities (and limitations) of future leaders and staffs. Echelonment also reconciles the inherent organizational tension between size and agility. Finally, echelonment reflects the reality that it is neither economical nor efficient to furnish every functional capability to every formation. Rather, the more varied and complex military activities become, the more necessary to delegate functional responsibilities among more than one level of organization.

Generally, when fewer consecutive echelons are required, translating intention into action is more rapid and less vulnerable to friction. There are limits to that equation, however. Beyond a certain point, flattening organizations so enlarges their span of control and increases the burdens on subordinate units that organizational sluggishness and operational risk actually increase. Moreover, the way in which successive echelons are constituted is as important as their number. Formations designed with a high level of organic self-sufficiency are—by that very quality—less easy to reconfigure, whereas formations with little organic structure require augmentation for robustness and durability but also can be retailored more rapidly and easily.

Objective Force organization reflects these considerations in relation to the operational conditions and methods described earlier. It—

- Locates self-sufficiency and tailorability at the echelons where they are most essential.
- Capitalizes on new information technologies to streamline decision making and coordination without overloading commanders and staffs.
- Provides for the routine cycling of combat and support units into and out of action.
- Reflects an expectation that future military operations typically will require the employment of joint enablers at much lower organizational levels than in the past.

Units of Purpose

In the context of today's echelons, we must account for the functions, tasks, and purposes of corps and divisions to establish the requirements for Objective Force echelonment. We use the UE to account for these tasks in our design work. It is imperative to place the UE in the context of operations in order to validate this assessment. The UA accounts for the functions, tasks, and purposes of the brigade and below. These units conduct combined-arms operations, employing fire and maneuver and tactical assault while maintaining freedom of action in tactical engagements. While the ultimate designations of Objective Force units of purpose remain to be determined, for the sake of discussion, today's designations can be used to discuss the functions they must be able to perform.

Echelonment in the Objective Force is a complex question that demands extensive analysis and experimentation. TRADOC has not yet defined all levels of command resident within the Objective Force. To discuss echelonment, Objective Force concepts employ a functional framework in which UEs perform tasks assigned today to divisions and higher-service headquarters. UEs—

- Link ground and joint forces and orchestrate ground operations that decide joint campaigns.
- Have the capacity to assume command of joint task forces.
- Provide the basis for combined-arms air-ground task forces.
- Resource and execute combat operations.
- Designate objectives.
- Coordinate with multiservice, interagency, multinational, and nongovernmental activities.
- Employ long-range fires, aviation, and sustainment.
- Provide C4ISR and tactical direction to UAs.

UAs are the tactical warfighting echelons of the Objective Force. For analytic purposes, UAs comprise brigade and below echelons. Maneuver UAs are the smallest combined-arms units that can be committed independently. Their function is to finish decisively by closing with and destroying enemy forces through integrated fire and maneuver and tactical assault. For continued developmental purposes, the core of the UA brigade is the combined-arms combat battalion that commands a number of organic small tactical units that fight as teams of fighting teams. The span of control of the UA brigade is four to six battalions. Maneuver UAs require the qualities of durability, endurance, and stamina. Brigades are expected to employ most combat battalions in dispersed yet integrated engagements while periodically cycling individual units into and out of contact to sustain operational momentum. Combat battalions must dominate the unexpected contact and be able to transition through several engagements in sequence.

Engineer Organizations

Developing organizational designs for engineers has begun by defining the capabilities that are required and those that can be embedded into the UA. We will use the term "modules" to identify a capability that is required to accomplish a low-level Army task. Each task will be broken down into squad-level detail with mission-essential equipment. These modules will be grouped together to form units that are consistent with the Objective Force design (such as brigades, battalions, and companies).

Engineer modules are now being developed; these modules will lead to grouping capabilities to accomplish vital engineer functions in support of Army missions. For example, engineer missions are described using FM 7-15, *The Army Universal Task List.* Under the Battlefield Operating System of mobility/countermobility/survivability, the combined-arms tactical manuever element is required to conduct mobility operations. A part of mobility operations is overcoming barriers, obstacles, and mines, which leads to subtasks of conducting breaching operations. Even under the concept of assured mobility these tasks will have to be performed when standoff neutralization or avoidance methods have failed.

Using the subtask "conduct breaching operations," we develop a list of modular capabilities that are required within engineer units to support this combined-arms operation. After reviewing all the tasks, we developed 10 groups of module tasks:

- Mobility (enhance mobility options by enabling bypass, clearing obstacles [out of contact], and breaching, when required).
- Search (detect and neutralize mines, unexploded ordnance, improvised explosive devices, and other offensive enemy use of obstacles at standoff).
- Reconnaissance (identify mobility opportunities and assess mobility restrictions).
- Shaping (proactively deny the enemy's ability to affect friendly mobility, while positively affecting enemy and gray mobility).
- Force protection (enhance friendly and neutral force survivability through employment of terrain and infrastructure reinforcement).
- Construction (through joint, organic, host-nation, and contract assets, provide infrastructure and services to meet mission requirements, including airfield/APOD repair/emplacement, LOC construction/maintennace, etc).
- Geospatial (provide terrain situational awareness to enable home-field advantage and quickly develop and continuously update mission-specific data sets).
- Force support (provide noncontiguous route support, area clearance, deception, and environmental support).
- Special-purpose (provide unique specialized capabilities in support of operations).
- Command and control (plan, integrate, and synchronize engineer capabilities required for mission success; command and control combined-arms and engineer UAs as assigned; control defile operations, which includes the ability to reach for assistance through information or modular capability outside of the organization).

As the modules are grouped together, modularity, tailorability, and deployability are key characteristics that are considered. Each modular design has three components:

- Personnel with key/unique equipment.
- Army TOE equipment required for major-theater war environment.
- Available commercial equipment that could be used in lieu of deploying the units' equipment.

This organizational concept opens up new deployment options. Some units may rapidly deploy a portion of their unit initially without all their fielded equipment and then lease commercial equipment at a forward location to begin operations while the rest of the unit, or other engineer units, deploy by conventional means. This gives us options to provide CONUS-based units with forward-deployed capabilities.

Conclusion

This is just the beginning of the total review that must be done to support the Army's Transformation Plan. It will take the involvement of the entire Engineer Corps to ensure that—

- The maneuver commander receives assured mobility.
- Current engineer capabilities are embedded in the Objective Force (may or may not reside in engineer organizations or equipment).
- Engineer units are operationally responsive and agile (ready, tailorable, and deployable).
- Requisite Objective Force capabilities that the engineers must provide (embedded, combined areas, or modular) are properly addressed and designed in accordance with the concept of assured mobiltiy.

The Engineer School and MANSCEN DCD engineer staff invite support and input from each member of the Engineer Regiment to help address these complex issues.

Mr. Fowler is a program analyst in the MANSCEN Directorate of Combat Developments, Fort Leonard Wood, Missouri.

Lieutenant Colonel(P) Johnston is chief of the Engineer Division, MANSCEN Directorate of Combat Developments, Fort Leonard Wood, Missouri.

Engineer Digital Command and Control

By Major Eugene Snyman and Mr. Kenneth Bergman

The Engineer Regiment has been working to develop digital command and control (C2) systems that facilitate maneuver support to the combined-arms commander. This work has been fully integrated with other efforts across the Army to automate battlefield functions. Although most of the work has focused on legacy systems, the intent is to posture C2 systems to support the operational concepts being developed for the Interim and Objective Forces. The current Army Battle Command System (ABCS) will move forward and transform as well.

This article addresses the chronology of the Engineer Regiment's efforts to complement Armywide efforts in development and transformation of command, control, communications, and computers (C4). The central requirement is that the future system will serve the needs of the combined-arms commander. Requirements that are more oriented to the engineer staff's needs should be considered as distinct from maneuver requirements. Digital C2 systems will enable the future vision of support to maneuver forces by defining actions necessary to ensure the mobility of the force: *see first, understand first, act first,* and *finish decisively.*

Background

With the proliferation, sophistication, and availability of digital technology in the late eighties came the natural impulse to apply digital solutions to battlefield functions. The introduction of systems such as the Standard Army Training System, the Unit-Level Logistics System, and e-mail facilitated broad steps toward unit automation. Engineers sought the same digital efficiency. In the early 1990s, USACE sponsored a Science and Technology Objective (STO) for the Engineer Obstacle Planning System (EOPS), which was a forerunner of the Maneuver Control System-Engineer (MCS-E). TerraBase provided staff officers the capability to quickly analyze terrain and distribute useful terrain-visualization products. SapperNET, developed by the 3d Infantry Division in early 1999, was the first use of the Tactical Local Area Network to post engineer reports to a Web server to share commonly used data. From this legacy, the 18th Airborne Corps developed CastleNET as a Web-based reporting system that could be adapted by any engineer unit. The Engineer School developed the Digital Topographic Support System (DTSS) to provide engineer terrain teams at the brigade, division, corps, and echelon-above-corps levels with automated assistance performing terrain analysis and creating topographic products.

Proponents of other Battlefield Operating Systems (BOSs) were simultaneously developing automated tools to assist in collecting, analyzing, and disseminating information relevant to their unique requirements. These included the MCS, Advanced Field Artillery Tactical Data System, and All-Source Analysis System. By the late 1980s, this confederation of BOS C2 systems became the Army Tactical Command and Control System (ATCCS). These systems funneled data directly from source to intended recipients, bypassing the wider community of staffs working to satisfy battlefield demands. This "stovepiping" of data was not originally a problem since it was understood that the staffs would distribute the relevant information. ATCCS had five systems. Since then, additional systems were added as the need for even greater BOS functionality became apparent. The ATCCS evolved into the current ABCS, which now has 11 systems.

The Division Capstone Exercise (DCX), conducted in two phases at the National Training Center, Fort Irwin, California (DCX I), and at Fort Hood, Texas (DCX II), better refined command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) requirements (see "Assessing Engineer Priorities in the Division Capstone Exercise," *Engineer*, February 2002). Commanders demonstrated how ABCS provided a common operational picture

(COP) and situational awareness that improved efficiency and lethality. While automation has transformed battlefield dynamics, the systems themselves have significant shortcomings.

During the DCX II after-action review/commandant's video teleconference on 5 November, TRADOC Commander, General John N. Abrams, addressed some of the broad issues confronting ABCS viability. Foremost was the observation that all systems lacked integration and were too oriented to meeting individual BOS requirements. He directed the Combined Arms Center Commander, Lieutenant General James C. Riley, to lead an effort to reassess the ABCS and make recommendations to TRADOC on whether to continue program funding, modify the system requirements, or discontinue the program. The following quote from Lieutenant General Riley addressed ABCS way–ahead efforts: "...overarching driver for final recommendations will be the degree to which each system integrates into the combined-arms fight in order to support situational understanding and decision making by combined-arms commanders."

Current Situation

There are distinct aspects of the commander's situational awareness that engineers historically manage. The Engineer Regiment is always cognizant of our fundamental purpose to support the combined-arms commander in the prosecution of the warfight. It is challenging to sort through the myriad of tasks and assign priorities from the maneuver perspective. In one sense, all our activities are oriented to the combined-arms fight, but the question really deals with the specific information the commander needs for decision making. These include preparation for combat, correlation and control of forces, knowledge of the enemy, and the effects of combat action. Many of the current capabilities in MCS are designed to meet the requirements of the battle captain. The commander probably does not need to see an engineer overlay dotted with little green marks; instead, he needs a visual analysis of enemy activity, considering obstacle effort grouped according to probable enemy intent. Similarly, the commander may not understand the significance of electronically highlighted routes and bridges until he sees how they fit with other aspects of terrain and with the scheme of maneuver.

The current thought is that considering the offensive focus of current doctrine and the emerging emphasis in the Interim and Objective Forces on assured mobility, obstacle situational awareness is one of the most important command requirements. Equally important is the ability of the commander to see the terrain and understand its effects on maneuver. Topographic engineers can provide a variety of digital tactical decision aids and terrain-visualization tools for maneuver support. Other important tasks must be automated as well. Legacy Force doctrine still accounts for defensive operations making survivability and countermobility tracking important in automation efforts. At this stage in ABCS development, various systems give us only pieces of the data sets required to create relevant command decision-making tools.

Maneuver Control System

The aptly named MCS does not adequately support the engineer's ability to package information for the commander. Although the initial requirements documents addressed the need to record and report obstacle information, developers focused efforts on other maneuver priorities and on system stability. Not until operational testing at the DCX did the extent of the deficiencies become clear. Currently, the MCS has no means by which engineers can track obstacles, much less perform mobility analyses. Very little of the obstacle data generated at ground level can be automatically sent to the MCS and, even then, there are no tools to manage and synthesize data into information.

As this system evolves, it must allow the soldier to accurately record friendly and enemy obstacles according to doctrine, post these immediately to the COP, and be able to update obstacle information in real time. Staffs must be able to receive, store, update, collate, analyze, and disseminate obstacle information and graphics up and down the chain in real time. Technically, this requires a database—fully compatible with other hardware and software—empowered with user-defined query capability and "fuzzy-logic" decision aids.

Force XXI Battle Command Brigade and Below

Development of the Force XXI Battle Command Brigade and Below (FBCB2) System, the fighting-platform-level reporting and situational-awareness system, accommodated engineer needs to a much greater extent than did the MCS. At the platform level, obstacle situational awareness is achieved. Obstacles discovered are reported in real time and populate the entire lower tactical internet. The systems in vehicles that are approaching recorded obstacles even give the drivers audible warning. However, during the DCX in early 2001, minefield fratricide became a primary point of command attention.

FBCB2 System

"It is envisioned that future versions of the FBCB2 System will simplify the obstacle reporting into one comprehensive report for both enemy and friendly obstacles."

The FBCB2 System provides three primary message formats that engineers typically use: the obstacle report, the minefield-laying report, and the overlay message. The obstacle report, intended originally as a means of reporting enemy obstacles, automatically displays the reported minefield on all FBCB2 screens. The minefield report and overlay message are intended for friendly minefields and graphic dissemination of engineer planning. While most of the relevant information is captured in these three reports, a complex combination of work arounds and tactics, techniques, and procedures involving all three reports is needed to push information to the intended recipients. It does not automatically make information digitally accessible to the higher echelons.

MCS-Engineer

To date, the MCS-E program has suffered from a lack of definition and focus within the ABCS construct. Although there has been work since the inception of the MCS to create a stand-alone C2 system, called MCS-E, for the mobility/survivability BOS, those efforts have fallen significantly short of the mark. There is also valid concern in the Regiment that another stovepipe box in ABCS would be a mistake. As a result, the Engineer School decided that MCS-E should be integrated directly into MCS. MCS-E is an effort to assist the TRADOC System Manager-MCS in meeting engineer requirements. It will provide engineers with a seamless, integrated set of tools in one easy-to-use software package. Capabilities will include countermobility, survivabilty, mobility, and sustainment tools. MCS-E will be integrated into the MCS-Light System. It will incorporate all of the functionality that currently exists in CastleNET and will have the added benefit of being totally integrated into the ABCS architecture.

It is intended that these tasks identified as most important to the combined-arms decision-making process be addressed by the MCS, while all additional, more staff-oriented tasks be incorporated into MCS-E. Integration of this effort is expected to coincide with MCS, Version 7.0, which is scheduled for release in FY04.

Digital Topographic Support System

The DTSS software is largely successful at the technical level and can be enhanced through software upgrades and doctrine, training, leader development, organization, materiel, and soldiers (DTLOMS) adjustments. Since it is able to leverage commercial software, the DTSS is a fully integrated member of the ABCS family and is a stable, reliable system in the field. Unique government applications provide added functionality to process digital terrain data. System upgrades are delivered to the field as software advances are achieved. Many products can be prepared using the DTSS, including tactical decision aids, slope analyses, intervisibility plots, and 3-D terrain fly-throughs. A map server was added at DCX II to provide a readily accessible archive for larger terrain-data files in the tactical operations center. The units performed well at the DCX, but mission performance standards (mission training plans [MTPs]) must be identified to better focus the soldiers on keeping their technical skills razor-sharp.

Joint Mapping Toolkit

The Joint Mapping Toolkit (JMTK) was designed to serve as a common system for terrain-data displays and some embedded-data analysis tools throughout ABCS. Problems with the initial release of the JMTK led to the variety of display software as each system sought its own display tool. There are presently seven different terrain-data-display software packages in use within the ABCS. This leads to a lack of commonality in terrain-data representation and functionality. The current version of the JMTK used at DCX II is more stable and capable than previous versions. External interfaces with DTSS and other ABCS members will increase the effectiveness of planning, execution, and reporting by engineer units.

Near-Term Prognosis

Using the DCX after-action review and consultation with the field, MCS deficiencies have been captured, articulated, and passed on to the TRADOC System Manager-MCS. The MCS-E will give us an opportunity to insert engineer functions into the MCS in its FY04 release and subsequent versions.

The FBCB2 System will release Version 4.0 in FY04 as well. The Maneuver Support Center's (MANSCEN's) Director of Combat Developments is working to refine the message format in the FBCB2 System to fix reporting shortcomings and facilitate database management of obstacles, but it is not yet clear whether these significant message format changes will be reflected in FBCB2, Version 4.0. There are varying degrees of difficulty in effecting changes with proponent, contract/cost, priority, and time considerations involved. A short-term solution involves changes to the existing message formats. The minefield symbol that autopopulates all other FBCB2 screens can be changed to capture the obstacle number; the drop-down menus in the obstacle report can be changed to better reflect obstacle status options; and the ability to edit existing obstacles can be added to circumvent the requirement to send additional messages about the same obstacle when the status changes. The task is further complicated because changes to the messages and Military Standard 2525B (Field Manual 101-5-1, *Operational Terms and Graphics*) must be approved by an interservice board.

CastleNET is essentially two subsystems (CastleNET-Reports and CastleNET-Visual) that currently require a manual interface. CastleNET-Reports (previously SapperNET) is a Web-based (SIPRNET) system at the task-force level into which reports from lower echelons (mobile subscriber equipment, FM radios, and e-mail) are entered. Standard reports include enemy and friendly obstacles, engineer missions, main supply routes, bridges, and logistics. Once entered, the data is saved to a relational database that self-replicates the data to databases at higher echelons, essentially creating several identical sets of data available for use at each echelon through corps.

CastleNET-Visual is an overlay-producing program used to create situational awareness and update the various commanders' COPs. As mentioned, the transfer of data from the reports database to a current overlay requires a multistep transfer of data on a Global Command and Control System box. Once the transfer takes place (one contractor or trained soldier is required full-time), several other manual data-transfer steps must take place to view the update on the corps COP and MCS-Light (personal computer/Windows-based). At this point, despite the manual processing steps involved (elapsed time 5-60 minutes), obstacle situational awareness is available for the commander's decision-making process.

CastleNET was successfully used during the 18th Airborne Corps Warfighter Exercise in early February 2002. It has received developmental Joint Forces Command funding through the Joint Area Clearance Advanced Concepts Technology Demonstration to determine the military utility of the system. With further funding, CastleNET could serve as an interim solution until MCS, Version 7.0, is released. Incidentally, the MCS-E is using much of the functionality of CastleNET to accelerate its developmental efforts.

The next software release of DTSS in the fall of 2002 will include a capability called battlespace terrain reasoning and awareness (BTRA). This new tool will enhance the capability of DTSS users to provide terrain-analysis products that can be rapidly modified as the battlefield situation develops. Meanwhile, understanding the use of digital topographic products will be enhanced through the development of a new Training Circular 5-230, *Topographic Smart Book*. This will increase awareness of potential DTSS products in the field and at the TRADOC schools for battle staff officers. There has always been a close relationship between the topographic engineer community and the intelligence community, especially in the use of imagery products. Engineer units in recent years have provided more oversight of topographic functions. This has increased the focus of the topographic units on both the friendly and enemy terrain regions, but some units seldom use imagery products from the intelligence community. The Engineer School is refining concepts with the Intelligence School through the Imagery and Geospatial Information Integrated Concept Team. Conclusions from this analysis will help refine the synergistic relationship between the topographic and intelligence functional areas.

Visualization of terrain data throughout the ABCS will be impacted by a congressional mandate for commercialization of the JMTK. The new commercial JMTK (C/JMTK) contract award should take place in FY02, with initial software release in FY03. Portions of JMTK software can potentially be incorporated into the C/JMTK. The Engineer School will participate in the development of the C/JMTK to manage capabilities and costs associated with software licenses, since thousands of computers will use this system.

Engineer C2 Roadmap

The figure on page 20 shows notional timelines for combat engineer and geospatial C2 developments and a concept for digital systems training at Fort Leonard Wood. The figure shows CastleNET providing current capabilities to support combat engineer tasks; CastleNET will be retired after the MCS-E is delivered. The DTSS will incorporate BTRA in the fall 2002 delivery, with continued software upgrades as commercial industry and government labs build added functionality. The Engineer School will accommodate digital systems training with the advent of these automated systems so that engineer students will see digital systems being used effectively before departing Fort Leonard Wood. MANSCEN assets will be used to show students how the MCS-E, DTSS, and other digital systems are employed.

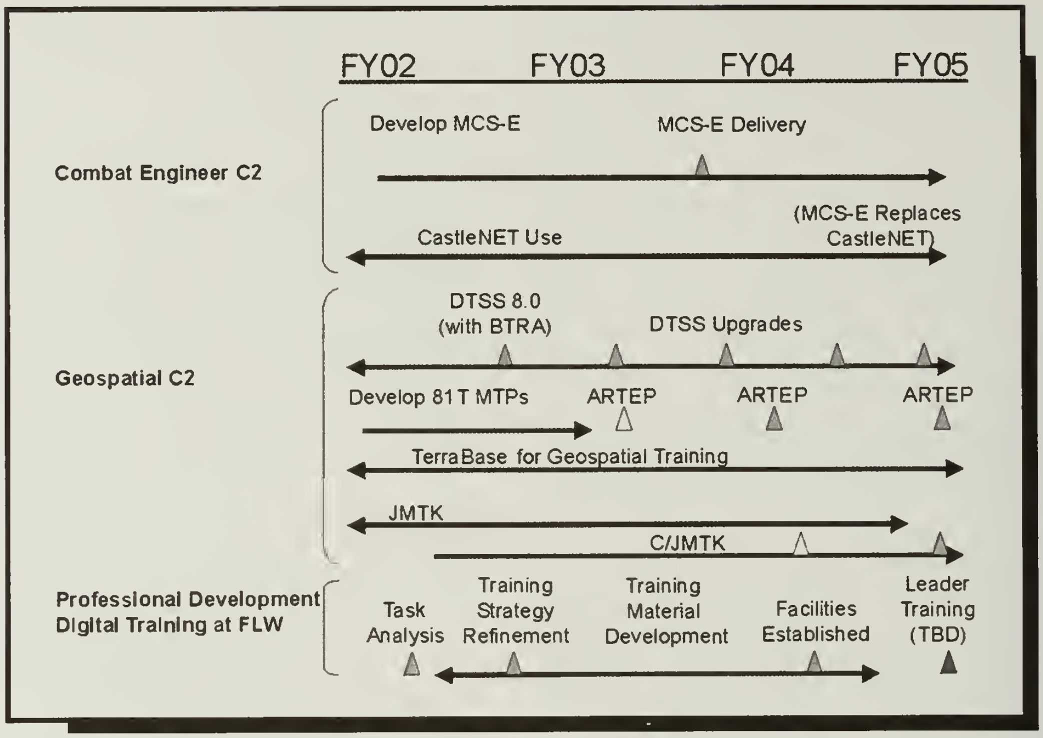
The Way Ahead

As previously mentioned, the ABCS way ahead was a series of conferences to review, update, and determine courses of action oriented to a final decision brief to General Abrams in early February 2002 to facilitate Program Objective Memorandum 04-09 input. The action officer conference methodology was used to conduct a mission analysis to develop a common understanding of ABCS capabilities, gain consensus from all stakeholders, and present the recommended courses of action to the TRADOC commander. All viable courses of action address actions to be taken after ABCS, Version 7.0 (MCS 7.0/FBCB2 4.0), to accompany the transformation of the Legacy and Interim Forces. A separate Future Combat System (FCS) C2 capability will be developed for the Objective Force.

The Objective Force concept is still in development. TRADOC is conducting a series of seminar war games to focus senior leaders on fleshing out operational and organizational issues. Other efforts are ongoing:

- A unit-of-action (UA) task force was stood up at Fort Knox during the fall of 2001.
- A full-time working group is exploring the nature and requirements of the FCS.

Engineer C2 Roadmap



- Five concept experimentation programs (CEPs) are underway, all oriented on transformation with full engineer participation.

In addition, the Engineer School has done an enormous amount of work exploring countermine requirements and solutions for the Objective Force Assured Mobility Concept.

Assured mobility involves actions that guarantee the force commander the ability to maneuver where and when he desires without interruption or delay to achieve his intent. It presupposes situational awareness through superior battlefield vision and understanding. The commander is able to develop a thorough mobility COP with geospatial products to help assess the environment and see the enemy's intent. With extensive support of sensor webs, he is able to select, establish, and maintain operating areas, from which he sets the conditions to fix and destroy enemy forces and move according to operational requirements. From an operational position of advantage, he can then attack at will, using stand-off detection/neutralization of obstacles. Finally, with the aid of embedded systems, he can breach residual obstacles and maintain mobility and momentum.

When the Objective Force operational and organizational concepts are approved, the current C4ISR requirements will be revisited with the intent of developing an integrated system structured around the needs of the commander. Taking advantage of current and future technologies, the Objective Force commander will have at his disposal tactical decision-making aids, collaborative and interactive planning tools, real-time access to reach-back expertise and resources, and the ability to conduct mission rehearsals on the move. It is clearly vital that MANSCEN and the Engineer School embrace a forward-focused posture to ensure that these systems serve the combined-arms commander with relevant information from the maneuver support community. These capabilities will be facilitated by enhanced engineer C2 systems which will give us information superiority to *see first, understand first, act first,* and *finish decisively!*

Major Snyman is chief of the Heavy Forces Division, Maneuver Support Battle Lab, Fort Leonard Wood, Missouri. Previous assignments include command of the 535th Engineer Company (CSE), 130th Engineer Brigade, Hanau, Germany, as well as executive officer and platoon leader in the 1st Engineer Battalion, 1st Infantry Division, Fort Riley, Kansas. MAJ Snyman is a graduate of the Engineer Officer Advanced Course and Command and General Staff College and holds a bachelor's degree in English from the University of Kansas and a master's degree in military science from the Command and General Staff College.

Mr. Bergman is the Deputy, TRADOC Program Integration Office for Terrain Data, Fort Leonard Wood, Missouri, through July 2002. Previous experience at the Engineer Research and Development Center-Topographic Engineering Center, includes the Rapid Terrain Visualization ACTD, Army Space Technology Office, and terrain database generation. Mr. Bergman is a graduate of the Naval Academy and holds a master's degree in systems engineering from George Mason University. A lieutenant colonel in the Marine Corps Reserves, his experience includes deployments to Beirut and Grenada.

Countermine Operations in the Contemporary Operational Environment

By Colonel Jeffrey P. LaMoe and Captain Ted Read

The events of 11 September initiated Operation Enduring Freedom and thrust engineers into a new operational environment. Legacy-equipped and -trained Forces are currently deployed in Afghanistan as part of Operation Enduring Freedom, operating in a nonlegacy environment. The challenge in Afghanistan is part legacy environment with a conventional force and part asymmetric, with the added complexity of terrorist organizations. The contemporary operational environment (COE) is a complex composite of all three of those elements. The Legacy Force in the COE causes multiple dilemmas; mines and booby traps are perhaps the most vexing. Engineers will spearhead a comprehensive combined-arms dialogue involving all the Battlefield Operating Systems to tackle the mine and booby-trap challenge of the COE.

The countermine dilemma in Afghanistan is daunting. The United Nations estimates that 6-10 million mines have accumulated since the 1979 Soviet invasion. Additional sources estimate up to 30 million mines (Training and Doctrine Command [TRADOC] Countermine Task Force Recommendations, 19 December 2001). Because the contemporary operating environment combines conventional, asymmetric, and terrorist environments, Afghanistan is a near-perfect surrogate to test systems and develop future solutions on a world scale.

A chilling aspect of the countermine challenge in the COE is that mines, booby traps, and improvised explosive devices (IEDs) are pervasive and converge as increasingly sophisticated and individually targeted devices that the enemy uses specifically to inflict casualties upon our soldiers. This is very different from our traditional perception of how the enemy uses mines to shape the battlefield or for area denial in conventional confrontations. Moreover, technology and globalization enable terrorist organizations (and unfriendly nations) to share successful and ominous tactics, techniques, and procedures (TTP) in a quick, efficient manner. This means that U.S. forces may well see devices and TTP that terrorists used successfully in Indonesia, Chechnya, Lebanon, or any other current conflict in the world. The ability to understand our adversaries' options and anticipate their actions in the COE is paramount to our near-term success and requires additional analysis of the enemies and the environment in which they operate.

We have traditionally regarded our enemies in the context of a peer competitor that is Cold War-organized to use mines to shape the battlefield. However, the COE, is "terror-centric" (see Figure 1) and uses mines, booby traps, and IEDs primarily as offensive weapons or for protection. The contemporary threat will most likely progress from a regional conflict to an asymmetrical conflict when U.S. forces arrive in theater. Regional

Paradigm Shift

- The operational environment changes how the Army operates.
- Reconcile and close the gap between the Legacy Force that is trained and equipped to face a doctrine-based, echeloned enemy and a force needed to to operate in a contemporary operational environment, faced with mines and technologically sophisticated booby-trap threats.

	Then	Now
Threat	■ Fight to win. ■ Peer competition. ■ Echeloned enemy using doctrinal row minefields to shape the battlefield. ■ Soviet "bear claw" complex obstacles against armored formations.	■ Fight not to lose. ■ Asymmetric, "terror-centric" threat. ■ Mining to inflict casualties and terror. ■ Emplace mines for protection and to fortify positions. ■ Legacy minefields from previous conflicts. ■ Discrete use of sophisticated command-detonated mines on individual targets.
Focus	■ Mine-centric to turn, fix, block, disrupt. ■ IPB—confirm or deny templated enemy, adjust plan, attack, find mines, conduct deliberate breaching operations.	■ Find mobility where traffic, people, and animals are moving. ■ IPB—predict the enemy's mine-emplacement plan and prevent emplacement.
Systems	■ Mine detectors, rollers, plows, line charges, and scouts.	■ Sensors, sensor cueing, change detection, and standoff mine detection and neutralization.
Operational Concept	■ Deal with mines encountered; in contact. ■ Use supress, obscure, secure, reduce (SOSR) fundamentals to set conditions and execute. ■ Task-organize support, breach, and assault.	■ Attack mining activity and ambush preparation; deter mine emplacement. ■ Set conditions to deal with mines and booby traps out of contact.
Enemy Risk	■ Mining is low risk and high payoff.	■ Mining is low risk and high payoff; we must turn this around and make enemy mining high risk and low payoff.

Figure 1

warlords know they cannot compete with U.S. forces in a direct confrontation, so the enemy's path is to win by not losing. The threat's offensive strategy of a "death by a thousand cuts" will continue until he can garner the military support or weaponry needed to win a decisive operation. The enemy may attempt to erode our national will and resolve by using mines and booby traps to terrorize field forces, inflict unacceptably high casualty rates, and degrade soldier confidence and morale—leaving them to feel defenseless, frustrated, and unprotected against an unseen menace. A full-spectrum analysis, incorporating a complex asymmetric and terrorist threat analysis, is needed to define the mobility and survivability tasks supporting freedom of maneuver in the COE.

Rethinking the threat requires that we also rethink ourselves. While the legacy paradigm assumed our enemies to be conventional peer competitors who fought to win (see Figure 1, page 21), our current enemy in Operation Enduring Freedom is more asymmetrical. The legacy paradigm also assumed that it was not feasible to prevent our enemy from emplacing a large number of mines. Given that prevention was not an option, the Engineer Regiment was "mine-centric" and expected to locate the mines, find a bypass, or if necessary reduce the mines through redundant means. The changes in the COE, combined with increased information dominance, gives us new capabilities and options in which to develop a countermine model. We can focus on deterring mine emplacement instead of reacting to mines that are already on or in the ground. The Engineer Regiment has a mandate and an opportunity, through a comprehensive combined-arms dialogue, to redefine how we will meet the COE countermine challenge and make the threat's emplacement of mines a high-risk, low-payoff operation.

To focus the Army's countermine effort, General John N. Abrams, TRADOC Commander, directed the Engineer School Commander to convene a combined-arms Countermine Task Force to recommend near- and long-term doctrine, training, leader-development, organization, materiel, and soldier (DTLOMS) solutions to enhance ground operations during Operation Enduring Freedom and develop an agressive countermine operational and organizational plan for the Objective Force. The task force used a combined-arms process to war-game potential missions in Operation Enduring Freedom to identify required countermine and counter-booby-trap capabilities. It focused on how to improve friendly countermine operations in Afghanistan by leveraging technology to—

- See the battlefield by developing a common operating picture (COP).
- Understand the threat and develop a comprehensive surveillance plan.
- Maximize sensor arrays to ensure early warning.
- Act decisively to neutralize adversaries before mine emplacement.

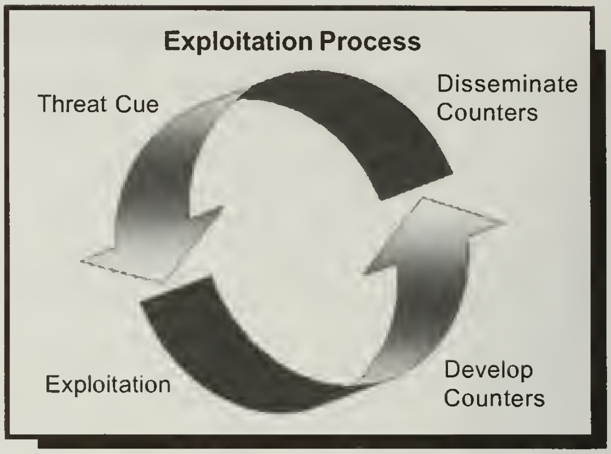


Figure 2

The Countermine Task Force's deliberate course of action analysis on all the missions yielded core requirements that will touch the full spectrum of engineering:

- "See and detect" both the enemy and mines.
- "Neutralize" mines outside their blast radius.
- "Clear" mines to maintain maneuver tempo.
- "Protect the force" from mine hazards.

In a briefing to the Army Requirements and Oversight Council (AROC) on 19 December 2001, the Countermine Task Force recommended selected near-term, commercial-off-the-shelf and government-off-the-shelf solutions for immediate acquisition to enhance ground operations in Afghanistan. Some of the solutions fulfill current operational requirements. The recommended solutions included: limited number of Minelab F1A4s—handheld mine detectors that are effective in high-ferrous soil; Antipersonnel Obstacle Breaching Systems (APOBS)—portable, rocket-propelled line charges; Improved Body Armor Sets, Individual Countermine (IBASIC); miniflails; mine-marking foam; small robots; and coalition/contract mine-detection dogs. These systems will help bridge the gap for units in Operation Enduring Freedom until better systems, such as the Handheld Standoff Mine-Detection System (HSTAMIDS) are ready for fielding under an accelerated time line.

General Abrams is fully committed to solving this combined-arms challenge. His guidance included the following:

- Employ the best minds available to develop materiel, operational, and training solutions to the countermine problem.
- Acquire and then reverse engineer the threat mine, booby-trap, and command-detonation architecture.
- Conduct a worldwide assessment to find innovative solutions in both training and materiel.
- Develop a Countermine/Counter-Booby-Trap Center (CCBTC) that will bring synergy to DTLOMS efforts and solutions.
- Set the dialogue, report progress, and identify resource shortfalls.

"In keeping with General Abrams's guidance, the Maneuver Support Center (MANSCEN) began efforts to establish a CCBTC at Fort Leonard Wood, Missouri, to bring combined-arms, joint, and allied efforts together on one team."

He made it clear that TRADOC's energy and resources will be committed to solving the countermine problem.

In keeping with General Abrams's guidance, the Maneuver Support Center (MANSCEN) began efforts to establish a CCBTC at Fort Leonard Wood, Missouri, to bring combined-arms, joint, and allied efforts together on one team. The center provides in-depth, worldwide assessments of current and emerging mine and booby-trap capabilities in order to actively fill information gaps and proactively seek out emerging capabilities, trends, and employment techniques. The center will focus and synchronize aggressive technical exploitation and science and technology (S&T) efforts, in addition to developing integrated DTLOMS solutions to protect forces and assure operational momentum against enemy employment of mines and booby traps.

Through a worldwide in-depth assessment of current and emerging technologies and employment TTP, the center discovers a "threat cue"—either a new way an enemy employs old mines, or the development of new mines (see Figure 2). The threat cue triggers exploitation of the threat architecture using our technology to quickly reverse engineer the threat cue and develop DTLOMS solutions from both internal resources and capitalization of worldwide countermine neutralization techniques and/or equipment (see Figure 2). The CCBTC will be a one-stop shopping mall for countermine solutions across the DTLOMS spectrum.We will build it into the world benchmark in countermine and counter-booby-trap training and technology. Our center will be a joint organization that will monitor mine incidents around the world, then tie new mine incidents into a collaborative fix between materiel solutions provided by the S&T from both the military and industrial communities and training solutions from the mine warfare training department. The center can be viewed as a hub for a continually moving wheel that searches the world for new enemy devices and TTP and DTLOMS countermine solutions and assists in the implementation of materiel and training solutions to the field.

Unfortunately, the Army has made little progress in developing technology to detect and neutralize mines over the past 60 years. Mine detectors (that detect metal), mine probes (to manually determine whether metal in the ground is a mine or a scrap), plows and rollers (brute force), and bangalores and mine-clearing line charges (explosives) are "state of the art" for mine detection and neutralization even today. Limited investment in standoff detection and neutralization programs is attributable partly to the technical complexity of getting beyond manual, brute-force systems that supported a legacy paradigm whose countermine solutions were limited to bypassing or breaching existing minefields.

This resurgent effort orchestrated by the Army's new CCBTC will lead the charge to reverse this 60-year trend by focusing on the COE to synchronize DTLOMS integration and concentrate research and development efforts. The effort also depends on maintaining a close collaboration with the combined-arms team and developing close partnerships with intelligence, special operations, infantry, armor, explosive ordnance (EOD), and chemical proponents to develop collective combined-arms training strategies to meet agile and adaptive adversaries.

The Engineer School is leading the TRADOC effort by forming a Countermine Integrated Concept Team (ICT) to accelerate implementation of DTLOMS solutions that meet the countermine challenge in the COE now and ensure mobility of the Objective Force. This ICT encompasses a Countermine Council of Colonels and a Countermine General Officer Steering Committee which will ensure that the countermine effort has sustained, top priority investment and commitment from the Army. In short, the countermine challenge is a combined-arms challenge that requires a full-spectrum analysis of the contemporary operating environment to ensure that we maintain the freedom to maneuver and increase force protection in any environment now and in the foreseeable future.

Colonel LaMoe is the Director of Training, U.S. Army Engineer School, Fort Leonard Wood, Missouri. Previous assignments include Senior Combat Engineer Trainer – Sidewinder 07, National Training Center, Fort Irwin, California, and Deputy Commander, 555th Combat Engineer Group, Fort Lewis, Washington. He holds a master of science degree from Michigan State University and a master of arts degree in strategic planning from the U.S. Army War College.

Captain Read is a geospatial-engineering instructor in the Tactics Department, U.S. Army Engineer School, Fort Leonard Wood, Missouri. He was previously an engineer observer/controller at the Combat Maneuver Training Center in Hohenfels, Germany, and commanded C Company, 9th Engineer Battalion, 1st Infantry Division in Schweinfurt, Germany. He has deployed to operations in Somalia, Haiti, and the Balkans.

Engineer Officer Education Transformation

By Lieutenant Colonel Jeffrey Bedey and Major Dallan Scherer

The United States Army Engineer School has been a key participant in every facet of transforming the officer education system (OES). The latest initiatives and changes to the way we will train our engineer officers in the very near future are captured in this article.

The Chief of Staff of the Army, General Eric K. Shinseki's, vision for Army Transformation as it applies to TRADOC is "...training and developing the force for 'strategic dominance across the entire spectrum of operations'...we will do it better, faster, and more affordably." TRADOC is not only the architect for change in the design of the Army's warfighting forces, it also has the key role to transform the institutional Army. In support of the Chief's vision, TRADOC Commander, General John N. Abrams, developed his vision for the future of leadership development for the Army. He has energized the force to—

- Identify the knowledge, skills, and attributes for leaders to be able to cope with the task of warfighting and war winning across the full spectrum of warfare as it relates to the world we live and operate in as reflected by the contemporary operational environment.
- Advance curriculums with experiential leader-development experiences relevant to the positions they assume upon graduation from TRADOC schools.
- Return to the core foundations of teaching tactics and learning tactics at the company-grade level; emphasize small-unit leadership development for lieutenants as well as tactical and technical competence.
- Advance the learning for combined-arms training for captains, and increase joint and combined operations knowledge and skills at the senior tactical level and operational level for military education level (MEL)-4 experience.
- Rekindle the passion and competence for training and for our training doctrine across the force, and put its application in the context of today's readiness equation.
- Focus on learning the traditions of Army service and its heritage.
- Reinvigorate the study of history as a medium for scholarship development as a lifelong enabler for learning and growing.

The end state is to develop competency-based learning requirements for officers, noncommissioned officers, warrant officers, and civilians at each level in support of Army Transformation. This will be accomplished by designing and executing transformation of command to align with Objective Force goals and by implementing institutional transformation strategies for training and leader-development systems.

To meet General Shinseki's intent, TRADOC implemented a Leader Development Campaign Plan (LDCP) to transform our current resident facility-focused system into one that is a more efficient model, focused on an officer's next assignment. The figure depicts how the Legacy Force OES, by course and duration from initial-entry training through the Command and General Staff Officer Course (CGSOC), will transform to meet the Objective Force education needs.

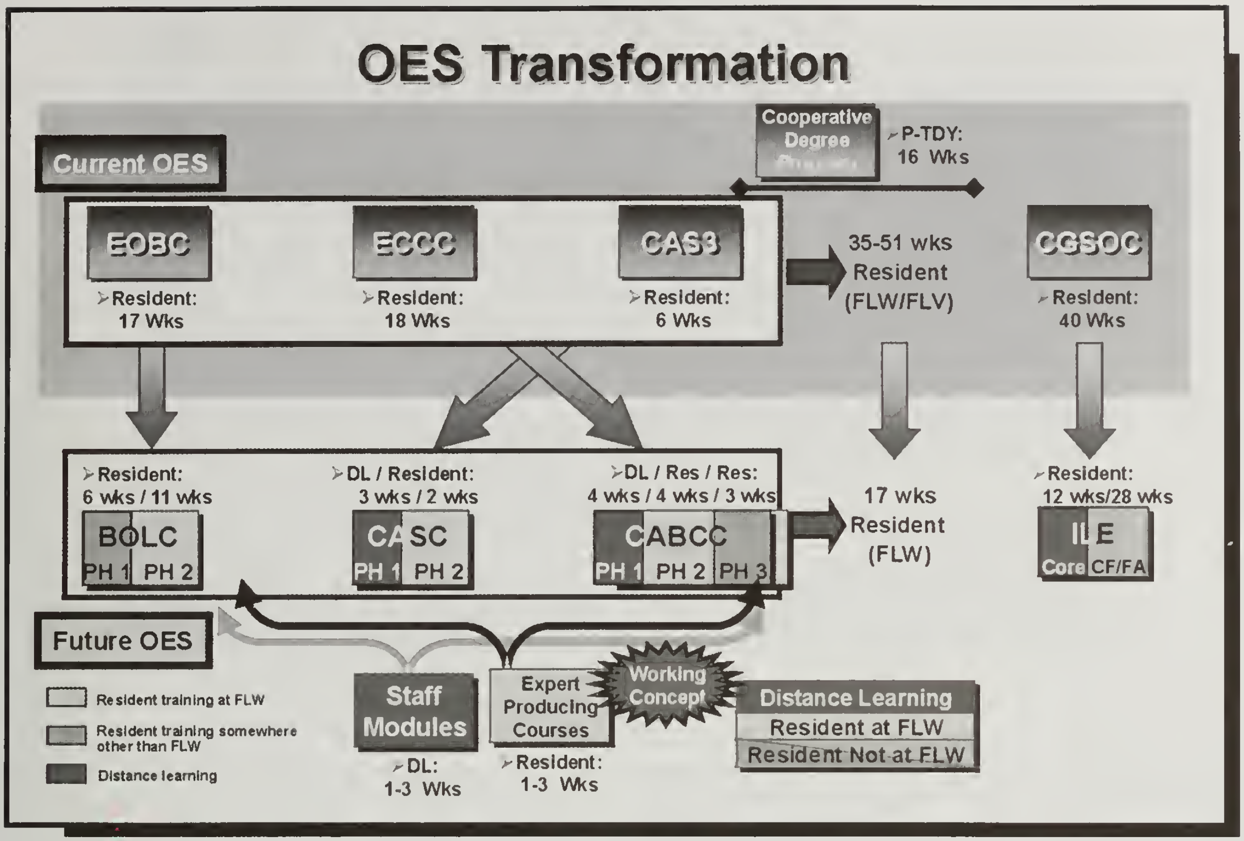
Looking at the current OES model, our junior-grade officers currently spend between 35 and 51 weeks training at Fort Leonard Wood, Missouri, or Fort Leavenworth, Kansas. The higher end takes into account the participation in the Cooperative Degree Program (University of Missouri-Rolla / University of Missouri-St. Louis/Webster University). As for our field grade officers, only 50 percent of a given year group are selected to attend CGSOC in residency for 40 weeks at Fort Leavenworth. Those who are not selected must complete their training by correspondence while still working full time in the field Army.

The **Basic Officer Leader Course (BOLC)**, which replaces the Engineer Officer Basic Course, will be conducted in two phases:

- **BOLC Phase I** will be trained at one or two consolidated locations (for example, pilots are currently being conducted at Fort Benning, Georgia). This 6-week course will develop leaders of all Army branches with character and confidence who are self-aware and adaptable and achieve excellence.
- **BOLC Phase II** will be trained at the Engineer School. This 11-week course will focus on engineer platoon leading and task force engineer skills, with an increase in tactics instruction (in particular, training on scatterable mines, geospatial engineering, and force-protection construction). In March 2002, we conducted our first BOLC Phase II pilot. Full BOLC implementation is targeted for FY03/04.

The **Combined Arms Staff Course (CASC)** will replace the Combined Arms Services Staff School (CAS3) (notice that the timing has changed to precede advanced officer training). This training will also be conducted in two phases:

- **CASC Phase I** will consist of approximately 120 hours of distance learning, to be conducted at the unit on both common-core and engineer-specific tasks focused on staff



officer skills and knowledge. The window for accessing this distance-learning courseware opens upon successful completion of BOLC Phase II and must be completed before attending CASC Phase II.

- **CASC Phase II** is a 2-week resident course at the Engineer School that maximizes constructive, virtual, and/or live training with a focus on staff functions. This training will revolve around combined-arms staff officers training with engineer-specific training embedded. Portions of this training are also envisioned to be Web-based combined-arms multiechelon collaborative simulation exercises. The first CASC pilot is scheduled for FY03/04. Full implementation is targeted for FY04/05.

The **Combined Arms Battle Command Course (CABCC)**, which will replace the Engineer Captain's Career Course (ECCC), will be very similar in execution as CASC, but will be conducted in three phases:

- **CABCC Phase I** will consist of approximately 160 hours of distance learning, which will be conducted at the unit and will include both common-core and engineer-specific tasks that are focused on company command skills and knowledge. The window for accessing this distance-learning courseware opens upon successful completion of CASC Phase II and must be completed before attending CABCC Phase II. Officers must be identified for company command to attend CABCC Phase II.
- **CABCC Phase II** will be a 4-week resident course at Fort Leonard Wood, with the focus on maximizing constructive, virtual, and/or live training with a focus on command functions. This training will also revolve around combined-arms training with engineer-specific training embedded. Similarly, portions of this training are also envisioned to be Web-based combined-arms multiechelon collaborative simulation exercises.
- **CABCC Phase III** will be a combat training center (CTC)-like experience with officers spending 3 weeks at the CTC that is most associated with their command. This training will focus on unit training and the after-action review (AAR) process—the intent being to develop "master trainers." The first CABCC pilot is scheduled for FY03/04. Full implementation is targeted for FY04/05.

Intermediate Level Education (ILE), a resident course conducted in two phases, will replace the CGSOC:

- **ILE Phase I** will be a 12 weeks long and will focus on common-core field grade training. All field grade officers will attend Phase 1 in residency; however, this training may be conducted at more than one location. Successful completion of this training will give an officer his MEL-4 rating.
- **ILE Phase II** will likely be resident; however, officers will attend training at different locations based on their career field and/or functional area. The first ILE pilot is scheduled for FY03. Full implementation is targeted for FY03/04.

Expert-Producing Courses is an Engineer School concept whereby an officer can receive highly specialized training. The vision is to develop a series of 1- to 3-week resident functional courses to produce experts in engineering-related tasks. One example is a Countermine Counter-Booby-Trap Course being developed now to provide expert training on the latest countermine and counter-booby-trap technologies and techniques to counter these hazards.

Notice the significant decrease in institutional resident training (from 35-51 weeks to 17 weeks). To offset this decrease, we must take advantage of existing and emerging technologies to create a means to package and export training to the field. One initiative of LDCP is to create a database for knowledge management and e-learning that can provide the right knowledge, training, and education on demand. This system, termed the "Warrior Knowledge Network (WKN)," will allow all Army personnel to access interactive courseware designed to be delivered anywhere, anytime, to meet the educational needs of the Army via distance or distributed learning (DL), on demand. This courseware will focus on preparing personnel for accelerated advanced learning and/or application of skills in a resident educational course.

Some of this training will be directed (CASC Phase I and CABCC Phase I) while other training will be self-development. Some of the self-development courses, termed **Staff Modules**, can be taken at any time following BOLC. For example, once an officer is identified to serve as a battalion S1, he could access the WKN and take the Adjutant Course Module, giving him the necessary skills and knowledge to perform in that position. The key is that through DL, anyone can learn the fundamentals needed to succeed immediately or "just-in-time" before assuming a new position. Other training that will be offered includes the Supply Officer Course (S4) and the Battalion Maintenance Officer (BMO) Course.

The common theme throughout the LDCP is to leverage DL to reduce an officer's time away from troops and shift focus during the resident training phase from learning skills to applying those skills. The benefit is twofold: the officer learns a skill when he needs the skill most, and he spends more time with troops and less time in the institutional environment.

You may have heard the terms "gauntlet training" and "crucible training." These terms are often used interchangeably; however, gauntlet training focuses on leadership training in a multiechelon, multigrade, synthetic/virtual-training environment, while crucible training refers to the same experience in a field environment. One of the goals of the OES transformation is to use this performance-oriented training to the maximum extent possible.

We are working to integrate this type of training at the Engineer School. The Department of Instruction and Department of Common Leader Training, in collaboration with the Armor School, are working to pilot a constructive simulation exercise via the Web for a gauntlet-type exercise. To further enhance this type of training, we are spearheading the integration of a suite of Force XXI Battlefield Command-Brigade and Below (FBCB2) Systems into a digital tactical operations center. These systems will support training requirements for the entire Maneuver Support Center (MANSCEN).

MANSCEN and the Engineer School are leading the TRADOC transformation and will very soon present a concept to ensure that the cooperative graduate degree programs are not lost. We are exploring multiple courses of action with several learning institutions to actually expand the ability for all engineers to obtain associate, bachelor's, or graduate degrees. The bottom line is that the Engineer School understands the importance of higher education and is determined to continue to provide a means to deliver higher civilian education opportunities.

Today's military missions and operational and strategic policies dictate that we produce skilled, self-confident, adaptive leaders who can win on any battlefield across the full spectrum of conflict. Focused, tailored training is key, whether it is preresident, resident, or postresident training. Providing expertly packaged, more frequent training for shorter periods allows the mind to better absorb and understand concepts and—overall—increase retention. This can be accomplished best by providing the right combination of distributive learning multimedia technology and capitalizing on combat training center and unit training. Our challenge is to wisely use the limited resources we have to develop the most effective and innovative training feasible. To successfully transform our educational system, it is essential that we continue to explore the use of existing and emerging technologies to enhance the delivery and design of future resident and nonresident training. We must ensure that we maintain the most realistic and challenging training and education possible.

Lieutenant Colonel Bedey is chief of the Directorate of Instruction, U.S. Army Engineer School, Fort Leonard Wood, Missouri. Previous assignments include commander of the 299th Engineer Battalion, 1st Brigade, 4th Infantry Division, Fort Hood, Texas, and S3 and company commander, 15th Engineer Battalion, 9th Infantry Division (Motorized). LTC Bedey is a graduate of the Command and General Staff College and holds a bachelor's degree in construction engineering from Montana State University and a master's degree in construction management from Colorado State University.

Major Scherer is chief of the Tactics Division at the Engineer School. A former commander of A/94th Engineer Combat Battalion (Heavy) in Germany, he also served as an engineer observer/controller at the Combat Maneuver Training Center. Major Scherer holds a bachelor's degree in automotive technology and management from Western Michigan University.

Comments can be sent to the authors at *bedeyj-@wood.army.mil* or *schererd@wood.army.mil.*

Developing an Engineer Strategy for Homeland Security

By Lieutenant Colonel Robert Hudnall, Lieutenant Colonel Monroe Nickell, and First Lieutenant Rachel Walkenbach

The threats of the 21st century demand a new approach to homeland security (HLS). The events of 11 September have caused us to focus more clearly on the connection between terrorists and other enemies of this country; the weapons of mass destruction they seek to use against us; and the social, economic, and political tensions across the world. President Bush has proposed an HLS budget that increased from $19.5 billion in the FY02 budget to $37.7 billion for FY03. The budget proposal nearly doubles funding for a sustained strategy of HLS focused on four key areas: bio-terrorism, emergency response, airport and border security, and improved intelligence. National sovereignty and HLS are top presidential priorities.

Our country is at war. Security of our homeland is a national priority. The present terrorism threat toward Americans requires a different perspective of what the constitutional requirement "to provide for the common defense and general welfare of the United States" means. In the near future, the President is expected to sign the Unified Command Plan, creating a new combatant command—U.S. Northern Command (USNORTHCOM)—responsible for HLS. The Implementation Plan will lay out DoD's requirements and guidelines for response planning tasks, command and control architecture, and training standards.

Engineer Roles, Responsibilities, and Missions

The Engineer Regiment must adapt its structure for HLS missions, roles, and responsibilities. Engineer leaders must discuss force structure changes that will be needed to prepare for, prevent, defend against, and respond to threats and aggression directed toward U.S. territory, sovereignty, domestic population, and infrastructure. We must look at the capabilities the Regiment brings to the table to accomplish these missions, roles, and responsibilities. Developing an HLS strategy should be on every engineer commander's agenda.

Department of Defense Job #1

"The primary mission of the U.S. military is first and foremost to fight and win our nation's wars. Service members are trained and ready to defend our nation from attack. Our military forces have previously worked and partnered effectively with civil authorities during times of natural disaster and will continue to do so."

-Secretary of Defense message 26 2330Z Oct 01

Although U.S. Army engineers have been a part of the HLS mission since its inception, it is now formally spelled out by the Secretary of Defense as a priority mission area. There will be two primary mission considerations for engineers as the Army develops its Objective Force structure capabilities—fighting and winning our nation's wars and defending the homeland.

Many engineer capabilities required to support civil authorities will be the same as those required to support military forces and installations in the prosecution of the global war on

The Department of Defense on HLS

HLS is not a new mission for the American military...we have been performing the mission for the past 226 years.

> "Many of our commanders feel comfortable in their ability to respond to requests by civilian agencies for support in dealing with natural or man-made disasters. There is a long history of exemplary service to our nation by all components of our Regiment. But the events of 11 September have greatly increased the stake we, as Engineers, have across the spectrum of our National Defense Strategy."
>
> -MG Anders B. Aadland

terrorism. There is a need to reassess today's engineer capabilities in order to support the full spectrum of Army requirements in the 21st century. There is a necessity to rethink how we are going to prepare our units to prevent or respond to attacks. Most CONUS response plans focus on natural disasters or isolated examples of man-made disasters. They are not geared toward responding to the asymmetrical terrorist threats now facing our nation. Future HLS responses by DoD will almost certainly be joint and multicomponent whereas, historically, the Army National Guard has been the traditional military component involved in civil-military training exercises and military assistance to civil authorities. The Total Army Analysis process is now considering the assignment of engineer units to this mission exclusively. Estimates are that as many as a dozen or more engineer units—to include groups, battalions, companies, and detachments involving thousands of engineer soldiers, primarily from the Reserve Components—will be assigned geographical responsibility to support HLS.

The Way Ahead

The Secretary of the Army's principal tasks for HLS:

- Consolidate responsibility for HLS—and the myriad of issues, functions, and responsibilities that touch the DoD staff—into a single organization.
- Complete a review of the operational planning for HLS through the Chairman, Joint Staff, and unified commands, to ensure that arrangements for HLS between various unified commands are optimal.
- Ensure interagency coordination with Governor Ridge's office and all the activities that he is undertaking.

"The good news is that there are many federal agencies working on all of these issues. The bad news is that there are many federal agencies working on all of these issues."

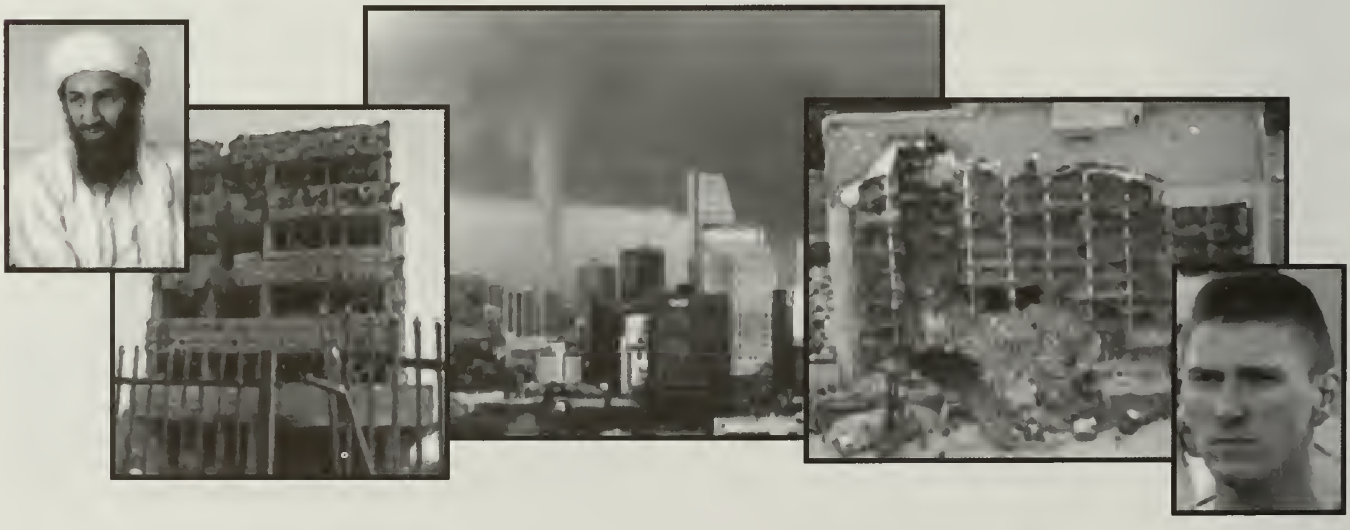
-Senator Fred Thompson

Engineers are a critical and dynamic part of the HLS mission area. HLS—by definition—WILL be a mission area for the Objective Force. The threat to our homeland will not diminish as we move into the future. In fact, it may increase as technology and financial capabilities of those hostile to our way of life grow. Leaders must think "out of the box" to develop new ways that Army engineers can contribute to the HLS mission. Engineers must be prepared to respond with well-trained and well-equipped units that can operate effectively.

Basic engineer missions of today have not changed as a result of the HLS requirements. But future HLS mission requirements may lead to a need for new technology and equipment. Terrain visualization, field-force engineering, and integration of environmental impacts associated with events involving weapons of mass destruction or natural disasters are areas where the Engineer Regiment has great potential to enhance our nation's HLS posture.

The HLS Challenge

A major challenge of the future involves building and improving civil-military relationships. Commanders can help initiate their piece of the HLS strategy by



Civil Support Missions

- Enemy attacks
- Insurrections
- Civil disturbances
- Earthquakes
- Fires
- Floods
- Tsunamis/tidal waves
- Meteor impacts
- Tornados
- Space debris impacts
- Animal diseases
- Mass immigrations
- Hurricanes/typhoons
- Volcanic eruptions
- Landslides
- Biological incidents
- Explosions
- Radiological incidents
- Snowstorms
- Droughts
- Oil spills
- Chemical incidents
- Epidemics
- Postal work stoppages
- Military support to civil authorities
- Military support for civil law enforcement
- Military support for civil disturbances
- Counterdrug operations
- Critical infrastructure protection
- Continuity of operations
- Counterterrorism
- State funerals

completing a unit HLS mission assessment. Leaders must consider these types of questions when creating their assessment:

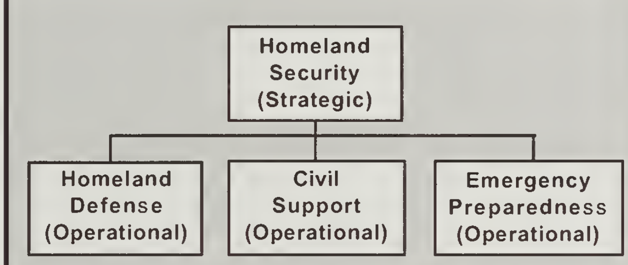
- What kind of mission might your unit be tasked with, and what are the requirements of agencies your unit may be supporting?
- Are local civilian or other military support assets available in your area?
- How does your current warfighting mission differ from an HLS mission?
- Are there different materiel or training support requirements?

This process will help identify missions your unit can or cannot accomplish. Local, state, and federal agencies can consider your capabilities in their emergency-response planning process.

Community Involvement

Emergency-response community involvement may be the most important area for integration, coordination, and synchronization of emergency-response tactics, techniques, and procedures. Engineer units will not be as effective initially in a disaster-response call-up if they do not communicate, plan, and train with local, state, and federal agencies that may request engineer support. The importance of getting involved in civil-military training exercises cannot be overemphasized. No one knows when the next terrorist incident will be, but we can help protect the future of our nation by getting involved now. Guidelines for conducting HLS training exercises will change as new doctrine is developed. For now, leaders must continue to plan, prepare, and rehearse roles as often as possible using current doctrine.

Mission Construct


Homeland Security (Strategic)
Homeland Defense (Operational)
Civil Support (Operational)
Emergency Preparedness (Operational)

Conclusion

HLS is not changing basic engineer missions or roles. It simply establishes a new emergency-response construct to deal with the challenges created because of terrorist threats and attacks. Engineers have successfully responded to disasters throughout our nation's history. Engineers of the 21st century will continue to be tasked to respond to natural and man-made disasters, except that now these missions may be in response to terrorist threats and attacks. Responding to the increased demands of HLS will be a challenge. HLS has been an important part of our Regiment contribution to the security and prosperity of our nation. From defending the homeland to winning our nation's wars, engineers will continue to move into the future as a full-spectrum force.

Lieutenant Colonel Hudnall is the U.S. Army Engineer School Deputy Assistant Commandant, Army National Guard, Fort Leonard Wood, Missouri.

Lieutenant Colonel Nickell is the Deputy Director of the Maneuver Support Center Homeland Security Office, Fort Leonard Wood, Missouri.

First Lieutenant Walkenbach is a U.S. Army Engineer School action officer for homeland security, currently serving with the Missouri Army National Guard at Fort Leonard Wood, Missouri.

Field-Force Engineering – A Regimental Approach

By Representatives of the 412th and 416th Engineer Commands and the U.S. Army Corps of Engineers

The Army is transforming to improve responsiveness to operations across the full spectrum of conflict. Army engineers have been a force multiplier and force enabler in every military operation since the end of the Cold War. This article outlines an ongoing initiative by the U.S. Army Corps of Engineers (USACE), the 412th and 416th Engineer Commands (ENCOMs), and the U.S. Army Engineer School to define how the Army Engineer Regiment must transform to meet the challenge of providing timely general-engineering support throughout the spectrum of conflict.

Problem

General-engineering response during contingency operations has been described as "ad hoc" and not following Army doctrine. Commanders typically have large unsatisfied engineering requirements when they need support most—early in the operation and again during posthostility operations. The challenge is to satisfy the requirements curve (see Figure 1).

Solution

Field-force engineering (FFE) links all the components of the Army Engineer Regiment into a seamless field-force engineer capability to provide timely general engineering to the warfighter throughout the spectrum of conflict. FFE specifically targets improving general-engineering support to contingency operations where friendly forces fluctuate quickly as the situation develops but are kept at a minimum end strength (see Figure 2, page 31).

Regimental Capabilities

The Engineer Regiment has enormous capabilities to apply across the spectrum of conflict. USACE, the ENCOMs, the Engineer School, the Directorates of Public Works, and contractors work together under FFE to provide seamless general-engineering support to the warfighter. Additionally, USACE, the Facility Engineer Group (FEG), and the ENCOMs can task-organize and send modular teams to meet diverse general-engineering requirements.

The ENCOMs have the following capabilities:

- Command and control.
- Augmentation of Army Service Component Command (ASCC) engineering.
- Theater planning.
- Facilities engineering.
- Troop construction.
- Geospatial engineering.

USACE has the following capabilities:

- Contract construction.
- Technical engineering.
- Real estate support.

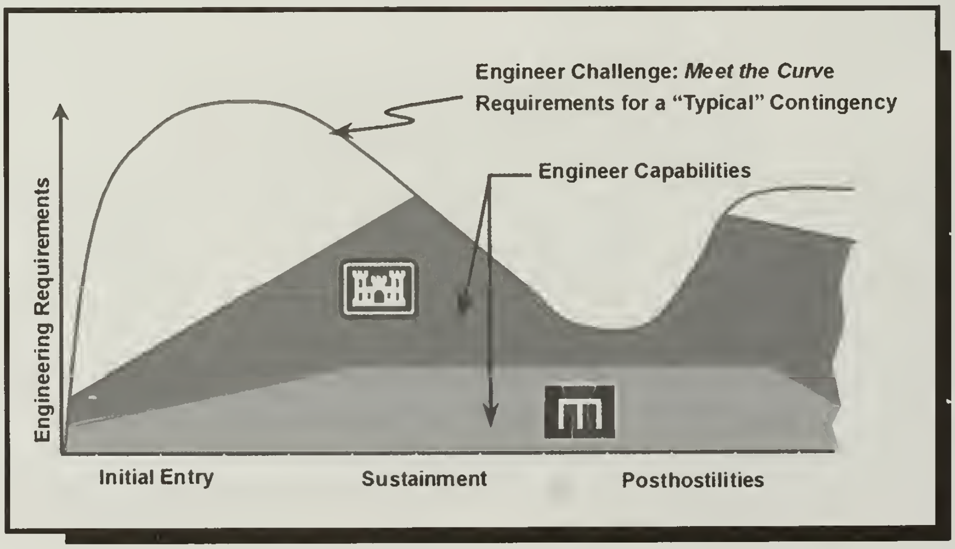


Figure 1. Engineer Support Shortfall

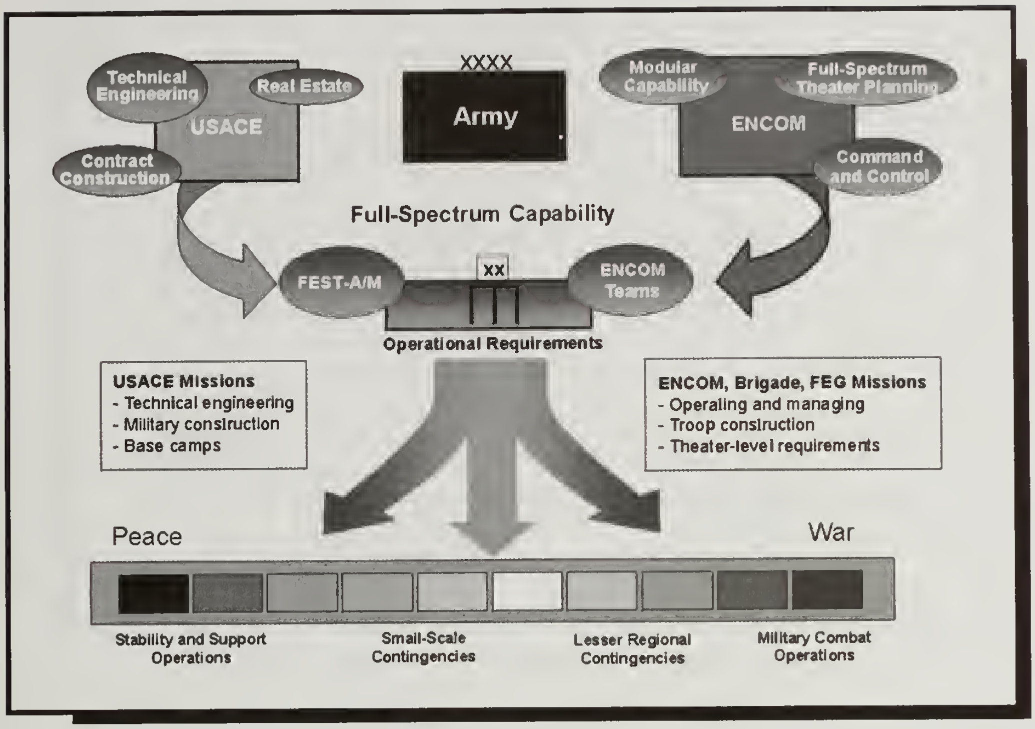


Figure 2. Regimental Approach

FFE Planning Structure

The structure provides an integrated Army engineer planning capability. Regimental ENCOM/USACE teams work for the joint task force commanders and/or the ASCC engineer to provide timely technical assistance. The ENCOMs have permanent forward-planning cells with all the ASCCs except U.S. Army South. USACE can deploy planning augmentation teams as required to support planning (see Figure 3 and the table on page 32).

Engineer Commands

The ENCOMs support each commander in chief (CINC) through the ASCC. The ENCOMs plan for flexible modular entry into the theater via early-entry modules, which range from several soldiers to a functional ENCOM command and control element. A one-size module does not fit all contingencies, so one or two early-entry modules are developed for early insertion into an operation as the situation develops. At some point, the "early operation" ends and further augmentation is the result of deliberate planning and specific capability requests through Forces Command.

The ENCOMs have multiple capabilities to put their soldiers in theater within days of mobilization by utilizing—

- Active Component and Title 10 active National Guard/ Reserve soldiers.
- Hasty mobilization (a new process endorsed by the Chief, Army Reserves).
- Temporary tours of active duty and active duty for special work.

Corps of Engineers

For contingencies, USACE personnel are organized as forward engineer support teams (FESTs). The FEST planning cell provides direct augmentation to the CINC/ASCC staff engineer or the ENCOM. The FEST execution team provides command and control for execution of USACE missions:

- **Forward Engineer Support Team–Main (FEST-M).** A deployable USACE organization that executes USACE missions in the area of operation. It is usually subordinate to the senior engineer commander.
- **Forward Engineer Support Team – Augmentation (FEST-A).** A deployable planning-augmentation cell that augments the engineer staff of other organizations (for example, CINC, ASCC, and ENCOM). If a FEST-M deploys, the FEST-A comes under the command of the FEST-M commander.
- **Contingency Real Estate Support Team (CREST).** A deployable five- to six-person real estate team and a component of a FEST. The team can quickly execute leases at forward locations.
- **Environmental Support Team (ENVST).** A deployable four-person environmental team and a component of a FEST. The team provides baseline and other environmental studies at forward locations.
- **Base Development Team (BDT).** A nondeployable team that can quickly provide base-development engineering and planning and facilities design for staging bases, base camps, forward-operating bases, and displaced-persons camps.
- **Infrastructure Assessment Team (IAT).** A nondeployable team that provides engineering infrastructure assessments

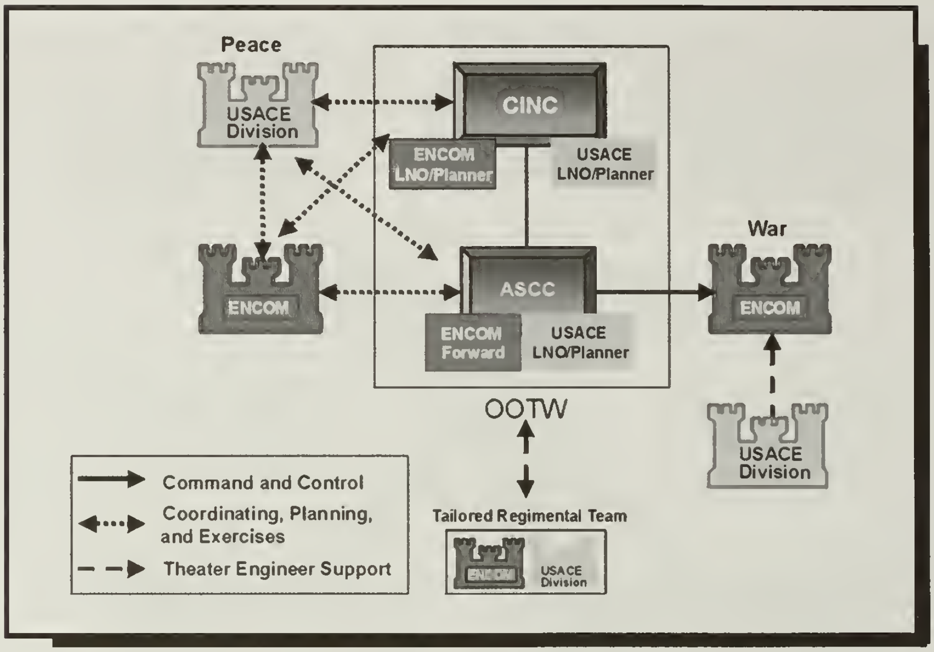


Figure 3. Field-Force Engineering Planning Structure

for military deployments and civil-military operations in forward areas. Focus areas for the IATs are the infrastructures related to USACE missions and aspects of the area of operation impacting contract construction, such as roads, utilities, water resources, and host-nation support.

Facility Engineer Group

The FEG is a 405-person table of distribution and allowances (TDA) and table of organization and equipment (TOE) group responsible for design and technical-engineering support as well as facility and environmental management, base operations, and force protection. The 416th ENCOM has peacetime command and control of the FEG, but during wartime, it is split between the ENCOMs based on the mission, enemy, terrain, troops, and time available. The FEG is comprised of six 15-person TOE facility engineer detachments (FEDs) and thirty 7-person TDA facility engineer teams (FETs) that are aligned under geographic Facility Engineer Centers, which provide command and control and administrative support. Each organizational element of the FEG is assigned a unique unit identification code for rapid and efficient deployment.

Facility Engineer Detachments

Three FEDs are war-traced to each major contingency operation ENCOM and aligned one per area support group. During peacetime, the detachments provide environmental and facility assessments, engineer design, and support to the Army Reserve engineer (50 percent), in addition to exercise participation, engineering planning, and design review (50 percent).

Facility Engineer Teams

The FETs deploy during wartime to conduct Directorate of Public Works, base operations, and environmental and facility

Field-Force Engineering Alignment

Commander in Chief	Supporting ASCC	Supporting ENCOM	Supporting USACE Division
U.S. Southern Command	U.S. Army South	416th ENCOM	South Atlantic Division
U.S. Central Command	U.S. Army Central	416th ENCOM	Southwestern Division
U.S. European Command	U.S. Army Europe	412th ENCOM	North Atlantic Division
U.S. Pacific Command	U.S. Forces Korea/ U.S. Army Pacific	412th ENCOM	Pacific Ocean Division
U.S. Joint Forces Command	U.S. Forces Command	N/A	North Atlantic Division**

** The North Atlantic Division supports the Joint Forces Command in its OCONUS area of responsibility. All USACE divisions support the Joint Forces Command in CONUS.

assessment missions. The FETs are under the command and control of the senior engineer in theatre. During peacetime, FETs provide environmental and facility assessments, engineer design, and support to the Army Reserve engineer.

Leveraging Technology

Reachback and TeleEngineering operations are terms used to describe the ability to conduct engineering analysis utilizing expertise that is beyond in-theater capabilities. The source of the expertise is linked real time via information technology to the mission site. The keys to this are the professional engineers, scientists, and technicians—combined with established procedures in the USACE, ENCOMs, and FEG. This allows real-time linkages of expertise to the operator via secure voice and video. The results are faster response times, a greater level of expertise in examining and solving problems/providing options, reduced deployment footprint and support requirements, and reduced costs.

Summary

This article focuses mainly on the functions, responsibilities, and capabilities of the engineer operational-level organizations formerly known as echelons above corps. It addresses the dynamic nature of the theater strategic and operational requirements across the spectrum of conflict. Field-force engineering is a means to get general engineers involved early in the planning of theater operations and to provide tailored support during execution. A breakout session at ENFORCE 2002 will provide further discussion of FFE.

The following people were involved in writing this article:

412th ENCOM:

COL Albert J. Bush III, Deputy Chief of Staff, Intelligence

MAJ John D. Bacon Jr., Plans Officer

CPT E. Scott Lowdermilk, Plans Officer

416th ENCOM:

COL Mark E. Eldridge, Chief of Staff

COL Neil W. Gafney, Chief of Staff, Facility Engineer Group

USACE:

COL William H. Fritz, Deputy Chief of Staff, Operations

Mr. Michael J. Shama, ODCSOPNS, Chief, Concepts Plans and Doctrine Branch

LTC Michael A. Alexander, Field Force Engineering Program Manager

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Articles should be concise, straightforward, and in the active voice. If they contain attributable information or quotations not referenced in the text, provide appropriate endnotes. Text length should not exceed 2,000 words (about eight double-spaced pages). Shorter after-action-type articles and reviews of books on engineer topics are also welcome.

Include photos (with captions) and/or line diagrams that illustrate information in the article. Please do not include illustrations or photos in the text; instead, send each of them as a separate file. Do not embed photos in PowerPoint. If illustrations are in PowerPoint, avoid excessive use of color and shading. Save digital images at a resolution no lower than 200 dpi. Images copied from a Web site must be accompanied by copyright permission.

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The Multicomponent Initiative:

Lessons Learned and Challenges Ahead

By Lieutenant Colonel Thomas E. O'Donovan

The multicomponent concept was implemented in the 52d Engineer Battalion, Fort Carson, Colorado, in October 1999, and the 52d became the first tricomponent battalion in the Army. Having passed our 2-year anniversary as a multicomponent unit, it is important that both our successes and challenges are presented to the engineer community. Because of our significant Reserve Component (RC) responsibilities, and the fact that an increasing number of engineer units are becoming multicomponent, we must ensure that the lessons learned as part of this important effort get to the engineers who need them.

Background

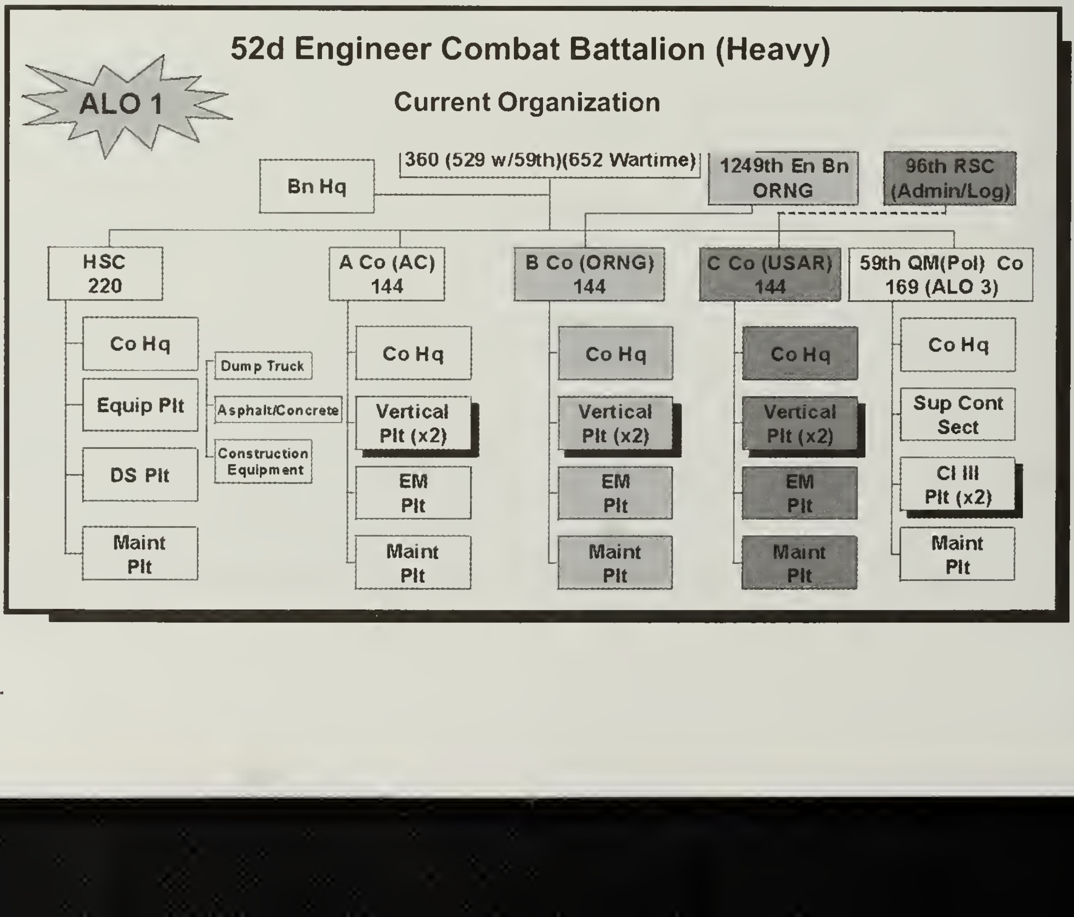
The multicomponent initiative is an Active Component (AC)/RC integration effort that is defined as being one or more organizations from different components organized in a single authorization document (modified table of organization and equipment [MTOE]). More importantly, the initiative makes one commander directly responsible for the readiness of one unit, organized from different components.

The 52d Engineer Battalion is an authorized level of organization (ALO) 1 tricomponent unit with an AC headquarters and support company ([HSC], 220 soldiers authorized), one AC line company (A Company, 144 authorized), one Army National Guard (ARNG) line company (B Company, Albany and Camp Rilea, Oregon), and one U.S. Army Reserve (USAR) line company (C Company, Santa Fe, New Mexico, and Fort Carson). This makes 44 percent of the battalion RC. Each RC company is stationed in two detachments to broaden the recruiting area. Training support for each RC company is provided by the geographically supporting Training Support Battalion (TSBn) from the 91st Division. The 1/364 TSBn, Fort Lewis, Washington, supports B Company and 1/361 TSBn, Denver, Colorado, supports C Company.

The overall mission of the battalion is that on order it deploys to any theater of operations, conducts general-engineering missions in support of U.S./Joint/Combined forces, and provides countermobility and survivability engineer support as required. Upon reorganization, the battalion adopted the multicomponent mission of reaching the very highest possible readiness of all components, using the individual strengths of each.

Training Events

Since the 52d's reorganization, three major training events have been completed. In the summer of 2000, about 120 soldiers from the AC portion of the battalion deployed to Oregon for annual training with B Company. The AC element provided command and control, construction support, and limited maintenance support for Operation Oregon Forest, a tactical construction exercise in the Deschutes National Forest. Later in the summer, the battalion went



downrange at Fort Carson with C Company for an exercise dubbed Coyote Castle, which involved tactical construction of projects for Fort Carson.

In 2001, the entire battalion deployed to South Dakota to participate in Exercise Golden Thunder. This 3,500-soldier exercise included ARNG and USAR units from across the United States in a Bosnia-based scenario. Again, the battalion executed tactical construction. All three of these training exercises involved training assessment modules (TAMs) of RC elements by our TSBns, opposing forces (OPFOR), and deployment operations by many different modes.

Smaller, battalion-supported training events have included range qualification, field training exercises (FTXs), and equipment operator training. At weapons ranges, AC soldiers supported qualifying RC soldiers, which al-lowed maximum use of critical RC training time. Integrated FTXs at Fort Carson allowed C Company to fall in on a battalion footprint that provided mess and medical support, a partially established perimeter, command and control, and maintenance support. This integrates the RC company and maximizes training time.

AC and ARNG soldiers of the 52d Engineer Battalion complete NBC training during Exercise Oregon Forest.

Successes

Wartrace. Commanders of B and C Companies can say with assurance that they understand who their wartime commander is. This has significant positive impact in terms of stating a unit wartime mission, developing a mission-essential task list (METL), and determining critical supporting battle tasks. These, in turn, can result in better (for example, more focused) training.

Integration With the Battalion. Through the execution of Oregon Forest, Coyote Castle, and Golden Thunder, we have made significant strides in integrating the company leadership into battalion operations. Coordination such as video teleconferences and telephone conference calls, e-mailing operations orders (OPORDs) and fragmentary orders (FRAGOs), backbriefs, and rehearsals were completed during the planning and preparation phases of the exercises. This allowed company and battalion leadership and staff to work together to identify and solve problems, coordinate training, and report accurate information. In an actual deployment mission, these foundations would prove invaluable to deployment success. Our efforts in integrating junior leaders included participation of company-level leadership of all components for ceremonies of many types, quarterly training briefs, participation in company training meetings, social events, visits to training, and a METL development and review conference.

Equipment Turnover. When the 52d became a multicomponent unit, we deactivated the active B Company at Fort Carson. We were able to send a large amount of equipment to the new B Company, which significantly modernized that unit. This could not have happened under Oregon's previous Department of the Army (DA) priority for equipment fielding. For an engineer unit, this is particularly notable because it allows Oregon to use that equipment in a wide variety of roles—from training to statewide assistance projects to providing support for disaster response and humanitarian relief.

Equipment Fielding. Designating the 52d as multicomponent brought all three components to one priority for equipment fielding. Previously, C Company's priority was very high due to its alignment with the XVIII Airborne Corps, while the AC portion of the battalion was somewhat lower, and the units that came to make up B Company were even lower. Therefore, C Company had a wide variety of equipment that had not yet been fielded to the rest of the battalion. This gave the AC companies an opportunity to use equipment, such as night-vision devices, that had not yet been fielded to them.

Although there have been challenges with the paint scheme (AC is tan and RC is three-pattern, but equipment is fielded in only one color), new equipment is now fielded to all three components simultaneously. This ensures that both operators and maintainers from all components have the opportunity to train at the same time or for the AC portion to receive training and then give the RC portion during drill or annual training. That commonality of equipment and training will significantly improve the battalion's capabilities for any mission.

Battalion Support. The structure of combat heavy battalions is particularly well suited to company-level multicomponent organization because much of the critical support required by the companies is organized at the battalion level. For example, the battalion aid station; the dump truck section within HSC that supports haul missions for the companies; the soils, survey, and drafting section within the S3 that provides those services

AC and USAR soldiers of the 52d Engineer Battalion build a bridge during Exercise Coyote Castle.

for the companies; the communications section; and the battalion direct-support maintenance shop are all at battalion level. Each of these has given support to our RC companies that might be difficult under other organizational structures. Examples range from weapons ranges to flu shots, to Single-Channel Ground-to-Air Radio System (SINCGARS) training, to survey support on projects, to maintenance assistance in preparation for annual training or readiness inspections. Further, for C Company, the advantages of having its next higher headquarters readily available has helped improve administrative processing of personnel actions, particularly for those where the AC battalion commander is the approving authority.

Interaction With the TSBn. A significant issue that was resolved early was which TSBns would provide coverage for our RC companies. The final decision of the 91st Division was to use the geographical footprints. This allows the battalion to focus on command and control and support of the companies, while the TSBns provide the observer-controllers for TAM evaluations, lane training exercises, tactical operations center exercises, and other training events. This approach is working well and continues to improve with time and focus.

Construction Support. The integration of C Company had added impact by allowing the battalion to develop construction projects on Fort Carson that supported C Company's training and Fort Carson's construction needs. This involved construction planning and technical support to C Company construction at a minimal cost to Fort Carson.

Funding. A challenging area, one success has been the transfer of USAR (Title 11) funds to Fort Carson to allow C Company immediate access to money for Class IX requisitions, temporary duty, and other important items. Additionally, the battalion has undergone an audit by the Army Audit Agency, which was seeking to find instances of mixing congressionally titled funds. Since the battalion had been very careful to ensure that there was no significant mixing, no significant findings resulted.

Staffing. To ensure better support and integration with the RC companies, the battalion sought to capture AC/RC expertise within the battalion headquarters. Selecting a command sergeant major with AC/RC (TSBn) experience proved invaluable. During the 3 years of preparing for and executing the multicomponent concept, the battalion experienced a 50 percent success rate of having field grade officers with previous AC/RC experience. These leaders' experience was important in coordinating with the 96th Regional Support Command and the supporting TSBns and in understanding the RC companies' issues. The battalion is scheduled to get authorization for a battalion-level administrator in FY03.

Partnership. The interaction of the 52d and the supporting unit for B Company, the Oregon National Guard's (ORNG's) 1249th Engineer Battalion (Mechanized), has had many positive aspects ranging from a better understanding of ARNG issues to support for each organization. This has been a real success story and an important part of ensuring consistent and effective guidance and support for B Company.

Future Challenges

Mobilization/Deployment Planning. Without getting too specific—due to classification requirements—one of our Wartrace deployment plans for the 52d now includes our RC; the other plan still does not. For the first one, our AC and RC units deploy together—with Fort Carson as their power projection platform—in a timeline that can be met based on current readiness. We have not had as much success with the other Wartrace deployment plan. Currently, only the AC portion of the battalion is listed, and this is counted as fulfilling the regional commander in chief's (CINC's) requirement for an entire battalion. Planners are aware of this but are having difficulty correcting the problem. If they adjust our arrival dates to reflect required training and deployment times that allow the battalion to deploy together, they will not have enough combat heavy battalions to meet the CINC's requirements.

Guidance. The multicomponent concept is still being developed. A 27 July 2001 DA policy letter improved guidance in many areas but did not focus on how to make the concept work. The three critical portions of the guidance—that units be of like modernization, be geographically proximate, and be given funding in all three components—are important guidance that is not fully implemented. Further, DA included time-phased force-development-list planning guidance that multicomponent units deploy together, which is also not fully implemented. Forces Command (FORSCOM) Regulation 350-2, *Reserve Component Training*, briefly discusses multicomponent units. Other forms of policy, regulations, and guidance at all other levels are still under development. Coordinated integration of the concept into guidance would impact positively on almost every challenge discussed here.

Impact on Soldiers. There are significant aspects to the multicomponent implementation that impact directly on soldier perceptions. Some RC soldiers have concerns that becoming part of a multicomponent unit increases the likelihood of deployment. One young soldier said, "If I had wanted to be AC, I would have stayed AC." Other soldiers look for immediate improvements in many aspects of their unit (such as equipment, funding, and training), improvements that in fact take time. Some soldiers fear an increase in operating tempo (OPTEMPO) that they are not willing to commit to. While these soldiers are clearly in the minority, each of these perceptions has an impact on the most important issue to RC units—personnel strength—and so must be addressed by both AC and RC leaders.

Impacts on the Readiness of AC Units. The time and resources invested in the multicomponent concept by the AC comes at a cost that includes impacts on the leadership, budget, and soldiers of the battalion and overall readiness of the AC side. A recent General Accounting Office report briefly referred to this impact in terms of OPTEMPO on leadership. This is particularly true in the 52d, where two RC companies with two detachments each means that a unit is drilling every weekend. While that situation is the norm for many RC battalions, it is challenging to sustain focus from the AC side. Also, the challenges of learning the procedures in three such disparate planning, resourcing, and administrative systems takes a significant toll on young staff officers—particularly, given that in AC battalions today, well over half the staff officers are senior first lieutenants waiting to attend the career course. These young officers are still learning the complexities of the AC system, not to mention the RC world.

Memorandum of Agreement (MOA). DA specified that an MOA among FORSCOM, the National Guard Bureau (NGB), and the U.S. Army Reserve Command (USARC) would ensure effective coordination between the three components for running a multicomponent unit. The MOA process for the 52d began in early 1999 with a series of conferences that concluded in early 2000. A final version of the MOA began circulation for signature at that time and still had not been signed as of this writing.

This is only one of several problems with the MOA process. Other issues include the difficulties inherent in establishing procedures for running a battalion at the FORSCOM/NGB/USARC levels. For example, the positive impact that completing and resourcing the MOA could have is the issue and accountability of items such as sleeping bags, cold-weather boots, mittens, and field packs for the Fort Carson detachment of C Company. The MOA specifies that Fort Carson will provide this support to those soldiers. This would allow the supply sergeant of C Company to eliminate all the items he currently controls (a significant workload) and the soldiers would draw from Fort Carson's Central Issue Facility. Then the soldiers would have the same equipment as the AC, and the supply sergeant would be able to focus on other areas. Funding shortages currently prevent resolution. This is just one example of the MOA challenge, but it illustrates the issue.

Conclusion

This is just a brief review of the actions of the 52d Engineer Battalion and a brief introduction to the multicomponent concept. With many other units already multicomponent—like the 14th, the 46th, and the 249th Engineer Battalions—we need to deepen the discussions to help this concept work for every multicomponent unit. The successes show how powerful the concept can be in improving the readiness of the Army. The challenges show just how hard it is. Even if you aren't in a multicomponent unit now, you probably will be someday. Or perhaps another way to look at it is that with 76 percent of the Corps of Engineers in the RC, you already are in a multicomponent unit—the Engineer Regiment!

Lieutenant Colonel O'Donovan relinquished command of the 52d Engineer Battalion in July 2001 and is currently a student at the United States Army War College. Previous assignments include assistant corps engineer, V Corp; S3, 40th Engineer Battalion, Germany; assistant professor, United States Military Academy, West Point; and commander, B Company, 62d Engineer Battalion, Fort Hood, Texas.

Self-Reliant, Resourceful, and Adaptable:

America's Engineers in the 21st Century

By Major Erik L. Stor

The initial report was wrong. It was always wrong. Yet we had to do something. We informed the battalion commander and briefed him on the situation: a young boy was badly injured while playing with unexploded ordnance near a mine-infested trench outside the local town. He managed to make his way back to a farm road and then got a ride to the hospital, where he was being treated. He told a doctor, who informed the local Implementation Force camp commander, that his friend was unconscious and still in the trench. The time was 1830 hours and darkness was quickly approaching. Under the rules of engagement, we were not required to react. But we did. The commander of B/23d Engineer Battalion already had a platoon on alert. Within minutes, a sapper squad equipped with mine detectors and basic suits[1] was en route to the trench. The brigade commander requested helicopter support. Using a spotlight, a helicopter flew up and down the trench line, looking for the injured boy. The search ended early in the morning when they found the dead body. It was the summer of 1996.

This example, though tragic, demonstrates a recent example of the ability of American engineers to respond quickly to unknown and unforeseen missions and threats. This ability to adapt, however, is not new. In fact, several engineer units during the 20th century, trained in engineer doctrine, have executed missions that challenged and forced our leaders to look for solutions that may or may not be readily available. This article will examine three of them during three different operations.

World War II

More than half a century ago, thousands of America's engineer soldiers entered the European theater of war, trained on assault river crossings, mine emplacement, and demolitions. However, when the engineers hit the beach, they encountered missions that would challenge their men and test their leadership. Not knowing what to expect, sappers from the 291st Engineer Battalion, commanded by Lieutenant Colonel David Pergrin, landed on Omaha Beach, just over 2 weeks after the invasion. The engineers' initial task was to provide support directly behind the 9th and 83d Infantry Divisions and maintain the quickly deteriorating 1st Army main supply route between Carentan and Ste. Mere-Eglise and south of Carentan toward Periers. The engineers would be faced with heavily mined and booby-trapped fields, villages, and buildings throughout their zone, as well as numerous bridges blown by retreating Germans.[2]

There were several areas where engineers adapted to an environment and faced missions that looked nothing like the missions they encountered at home-station training. The first of these was the initial advance into France. Advancement was very slow through the Norman bocage because of the massive walls of hedgerows, each about 12 feet high and 8 feet thick. In addition, whenever troops smashed through a hedgerow, they encountered German minefields hastily emplaced as they withdrew across the fields and along the connecting roads.[3] Along with the hedgerows were waterways, trenches, deep valleys, orchards, and wooded areas. There was no doctrine to bust through. In fact, there was no equipment available. Based on a recommendation from one of his lieutenants, Lieutenant Colonel Pergrin

Unexploded ordnance, such as these 500 kg bombs, provided a challenge to the engineers at the airfield base camp in Afghanistan.

ordered that several of the bulldozer cabs be protected "by means of makeshift armored driving compartments."[4] The first of the "armored" bulldozers began crashing through hedgerows followed by advancing infantry shortly thereafter.

Another example of engineer adaptability was in employing mine detectors. Designed to detect metal in antipersonnel and antitank mines, mine detectors were the primary means to clear a mined area. Not anticipated, however, was the use of the mine detector to clear a path to recover dead paratroopers in the mine-infested swamps around Omaha Beach.[5] Trained engineers could be counted on to complete this morbid task. The 291st Engineer Battalion constructed 67 bridges (11 under fire), cleared 7,000 mines, deactivated 15 bombs, took 8,500 prisoners, and rescued 235 noncombatants.[6]

Vietnam

Twenty years later, America's engineers would again prove to be self-reliant, resourceful, and adaptable during the early 1965 troop buildup in South Vietnam. Because the active duty engineers lacked the manpower base at the beginning of the troop buildup, and because there were only two engineer training facilities, units going to South Vietnam were woefully short on engineer experience and skill during the first year.[7] The initial engineer missions included supporting the tactical operations, constructing logistical facilities, and "making the environment amenable to the Army interests."[8] During the initial planning, engineers estimated that there were 170 battalion-months' worth of engineer effort required and only eight active battalions deployed, leaving almost 2 years to accomplish the work.

Engineers showed their adaptability in several situations. The first of these was the requirement to clear areas for camps and helicopter landing pads and open major transportation routes. The thick jungle vegetation and trees posed a significant obstacle to the land-clearing operations. The fix was the Rome plow—a special tree-cutting blade that replaced the standard blade on the D7E tractor. As engineers discovered during World War II, a special heavy-duty protective cab was needed. In this case, it was standard issue. The perilous job of operating the Rome plow almost guaranteed that the engineer would "statistically cinch…a Purple Heart."[9] The significance was the "fact that these engineer soldiers were not specially trained or screened for land-clearing assignments."[10]

One of the "hulks" in Afghanistan that needed to be moved for C-17 traffic. Soviets left the MIG, stand, and tools right on the spot.

Next was the requirement to clear tunnels. The 1966 search-and-destroy tactics uncovered a vast network of tunnels that was as much as 20 years in the making. "Constructed in impervious layers of hard clay at varying depths, with small, well-camouflaged entrances, these tunnels defied any simple method of destruction."[11] Engineers put together a tunnel-demolition team, known as "tunnel rats," that developed several means of destruction. One way was to prepare and place explosive charges deep in the tunnel with sacks of powdered riot-control agents placed on top of the charges. The chemical remained effective from 2 to 6 months. Another method was to use acetylene gas, and still another way was destruction by flooding. Again, the significance was the fact that these engineer soldiers were not specially trained or screened to be tunnel rats.

Finally, engineers in Vietnam conducted quarry operations, constructed fuel pipelines, cleared miles of jungle, moved tons of earth, repaired hundreds of bridges, and installed steel matting for numerous airfields[12] —again, missions that were nothing like the ones they encountered at home-station training.

Bosnia

America's engineers, 25 years later, would again prove to be self-reliant, resourceful, and adaptable during operations in Bosnia. Thousands of engineer soldiers entered the Balkan region trained on mobility, countermobility, and survivability. However, when the engineers from the 23d Engineer Battalion arrived, they found that very little—if any—of their home-station training or Combat Maneuver Training Center rotations had prepared them for the yearlong deployment. The initial problem the engineers faced was a great deal of mud and mines. With the majority of the Posivina Corridor comprised of lowlands in the vicinity of rivers, minefields, destroyed towns and factories, occupied communities, and agricultural fields, engineers would again have to execute missions that were not by the book.

The first example was with the U.S. Army Europe and V Corps initial plan for base camp construction. The plan was for a brigade operating base (BOB), housing 1,800 soldiers and equipment, and two forward operating bases (FOBs), housing 1,200 soldiers and equipment each. When the engineers assessed the terrain and the maneuver commander's intent, the BOB and two FOBs would not be feasible. From the perspective of hardstand parking, engineers faced the option of constructing the BOB/FOBs in operating agricultural fields or upgrading damaged hard facilities. Based on soil conditions, water table levels, vehicles stuck in fields, and current on-the-ground experience, engineers had to adapt and reevaluate the recommendation. The solution was a combination of constructing operating bases in agricultural areas and on hardstands in a local town.

Next was the "doctrinal" classification of the numerous routes in the area of responsibility. The problem with FM 5-36, *Route Reconnaissance and Classification*, is that it does not address mines on routes or the status of a route after it has been proofed. The solution was the implementation of a "route status" to enhance and clarify FM 5-36. Additionally, the unit implemented a route tracker that the task forces updated and provided to the brigade via a fragmentary order twice a month. The tracker included the date the route was cleared and proofed, if it was marked, the military load class, and a comment block that could include the type of surface, bridges, and any obstructions (such as large potholes). This route tracker greatly enhanced the unit's ability to plan patrols and eventually transfer the sector to another unit. By using existing doctrine, engineers developed a useful tactic, technique, and procedure for tracking routes and adapted to a new environment.

Engineers were constantly updating the route status by conducting reconnaissance in the sector. On one such patrol, locals—complaining that their horse-drawn carts would not cross an armored, vehicle-launched bridge (AVLB)—approached the engineers and asked them to remove the bridge. A horse had fallen between the roadway gap and had fractured a leg. Knowing that removing the AVLB was not an option, since M1 tanks frequently used it, the engineers installed decking to cover the gap.

This problem identified a requirement for the engineers to hold forum or an engineer joint military commission (EJMC) with local engineers in the former warring factions (FWFs). So, on 1 March 1996, the 23d Engineer Battalion held the first of several EJMCs. Located in a temperature-controlled (temper) tent on a pothole-infested parking lot next to a partially destroyed diner, the three FWF engineers met for the first time since the war. Sappers from the 23d Engineer Battalion provided security and escorted the FWF engineers to the site. The meeting lasted for 3 hours and uncovered, for the first time since crossing the river, the complexities involved with meeting requirements outlined in the Dayton Peace Accord and other non-military-related engineer problems, such as the decking requirement for the AVLB. This showed how an engineer unit—trained on mobility, survivability, and countermobility tasks—adapted to a new environment, demonstrated its flexibility, and quickly learned how to live in a very austere and dangerous post-combat zone.

Conclusion

These examples show how America's engineer units during World War II, Vietnam, and Bosnia—trained in engineer doctrine—demonstrated that, while doctrine is our bedrock, there are situations that will challenge and force our leaders to look for solutions that may or may not be readily available. Adaptability and flexibility of our soldiers must remain paramount. I firmly believe that doctrine is the foundation of our training, and it directly led to the success of our engineers on the battlefields and deployments mentioned above. In fact, FM 5-34, *Engineer Field Data*, provides engineer soldiers at all levels with a source of reference doctrine that is handy and useful. However, I also believe that soldiers and leaders will face "junk-yard-war" -type scenarios (especially for engineer units entering an immature theater) that will reward creativity and original thought. A "can-do" attitude in conjunction with a sound understanding of engineer doctrine will ensure mission accomplishment. I predict that this will last well into the 21st century.

This is not to say that we should change our development of doctrine or stop training. On the contrary, I suggest that we need to step up our training to make it tougher and more *realistic*. An example of this could be an engineer squad leader taking his squad to a local junk yard and constructing steel hedgehogs or tetrahedrons out of vehicle hulks (apparently not in short supply in numerous operations). Take it a step further and assume that the hulk is booby-trapped. This kind of "out-of-the-box" training—coupled with FM 5-34 and a complementary professional-development program that includes thought-provoking historical studies—will increase our ability to be self-reliant, resourceful, and adaptable.

Major Stor is the assistant division engineer for the 10th Mountain Division, Fort Drum, New York.

Endnotes

[1] A Kevlar overgarment with thick antiballistic boots and gloves.

[2] Pergrin, D. *First Across the Rhine.* New York, New York: Macmillan Publishing Company. 1989, p. 26.

[3] Pergrin, p.32.

[4] Pergrin, p. 34.

[5] Pergrin, p. 25.

[6] Pergrin, cover page.

[7] Ploger, R. Major General,. *Vietnam Studies U.S. Army Engineers 1965 - 1970.*

Washington, DC: U.S. Government Printing Office, 1974. p, 23.

[8] Ploger, p.199.

[9] Ploger, p.103.

[10] Ploger, p.104.

[11] Ploger, p. 92.

[12] Ploger, p. 95-129.

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Operation Enigma Strike:

Testing the Deployability of the 130th Engineer Brigade FEMs

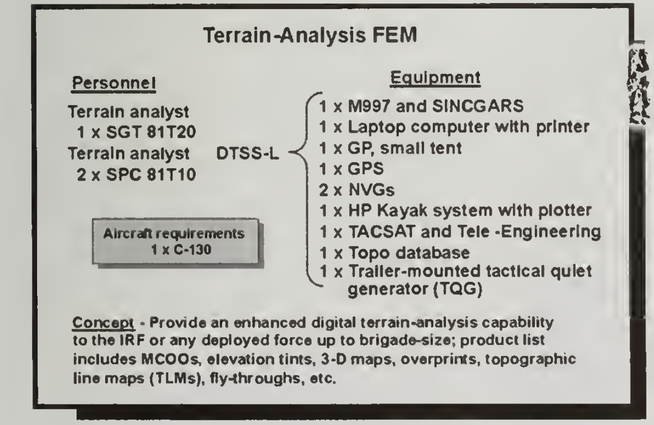
By Major George Simon and Captain Christopher Jeszenszky

In the May 2001 issue of *Engineer* ("Transforming the 130th Engineer Brigade…One Step at a Time"), the 565th Engineer Battalion, located in Hanau, Germany, described its Force-Enhancement Modules (FEMs) developed in conjunction with the 130th Engineer Brigade. These FEMs provide the U.S. Army Europe (USAREUR) Immediate Ready Force with engineer-specific capabilities such as bridging and topographic support. The FEMs are part of the USAREUR initiative to transform the Europe-based Legacy Force into an agile, responsive, deployable force that supports the Army Transformation.

Soldiers of the Deployment Processing Center pusher unit wash vehicles before the Air Force joint inspection.

The next step—after building the FEMs based on the initial concept, as shown in the May article—was to conduct a test of the entire deployment process. While the FEMs from the 565th looked good on paper and in the motorpool, the battalion and companies did not have experience in the full-deployment process. Everything needed to be tested—from the soldiers and vehicles comprising the FEMs to the company- and battalion-level staffs that would plan and execute the deployment. Deployment planning had not been done in the battalion since its mission to support Task Force Hawk in Albania in 1999, and a concept such as the FEMs had never been considered.

Since the battalion had recently been tasked with numerous support missions in the Balkans, this was a likely scenario to use for the FEM deployment exercise, named Operation Enigma Strike. The initial attempt was to find a mission in the Balkans with which to exercise the FEMs, but continuously changing dates and requirements forced the battalion to develop its own mission. The battalion staff went to work planning a Kosovo deployment, which would utilize the terrain-analysis FEM (Table 1) and the bridge-construction/reconnaissance FEM (Table 2, page 42).



Terrain-Analysis FEM

Personnel

Terrain analyst
1 x SGT 81T20
Terrain analyst
2 x SPC 81T10

DTSS-L

Equipment

- 1 x M997 and SINCGARS
- 1 x Laptop computer with printer
- 1 x GP, small tent
- 1 x GPS
- 2 x NVGs
- 1 x HP Kayak system with plotter
- 1 x TACSAT and Tele -Engineering
- 1 x Topo database
- 1 x Trailer-mounted tactical quiet generator (TQG)

Aircraft requirements
1 x C-130

Concept - Provide an enhanced digital terrain-analysis capability to the IRF or any deployed force up to brigade-size; product list includes MCOOs, elevation tints, 3-D maps, overprints, topographic line maps (TLMs), fly-throughs, etc.

Table 1

The battalion executive officer led the staff through the military decision-making process, creating a realistic scenario and operations plan for the mission. The scenario was so well conceived and the staff so secretive about the mission that the soldiers in the companies believed that they were actually going to Kosovo for up to 30 days.

The real challenge though was in the resourcing and execution of this massive plan. The resourcing fell to the battalion S3 training officer and the battalion S4 supply officer. Since this was not an operational deployment, the 130th Engineer Brigade had to pay for the flight time, and genuine operational deployments to the Balkans were given flight priority. The initial intent was to fly to Kosovo, but restrictions on the number of forces precluded the units from doing so. The next best option was to deploy outside of Germany. Given the 120+ day time requirement to process these requests through the various Ministries of Defense, this option could not be used either. The remaining option—

which was ultimately used—was a flight within Germany, from Ramstein Air Force Base (AFB) to Rhein-Main AFB.

Once a flight was established, a date for the FEMs to process through the USAREUR Deployment Processing Center (DPC) had to be secured. The next challenge came when the battalion discovered that the DPC required units to schedule a practice activation 120 days in advance. Since past interaction with the DPC was limited to the battalion operating the DPC or processing during operational deployments to the Balkans, this was mistakenly overlooked. Fortunately, the battalion was able to coordinate a shared processing time with another Hanau unit, 5-7 Air Defense Artillery, which was conducting a validation exercise during the same period.

As this drama unfolded and the plan solidified, the companies were busy preparing their soldiers and equipment for the deployment. The 38th Engineer Company (Medium Girder Bridge), which owns the bridge FEM, and the 320th Engineer Company (Topographic), with the terrain-analysis FEM, had much experience in deploying soldiers to the Balkans. The seasoned NCOs lead the newly arrived NCOs and soldiers through the preparation. The soldiers went through all of the necessary predeployment preparations—from briefing to physicals.

Bridge-Construction/ Reconnaissance FEM

Personnel	Equipment
Combat bridge crewman	1 x M998 with SINCGARS
1 x SSG 12C30	1 x Laptop computer with printer
Combat bridge crewman	1 x GP, small tent
2 x SGT 12C20	1 x GPS
Combat bridge crewman	2 x NVGs
1 x SPC 12C10	1 x Fixed-bridging manual set
	1 x TACSAT and Tele -Engineering

Aircraft requirements
1 x C-130

Concept - Conduct bridge and route reconnaissance and supervise construction of Mabey Johnson/Bailey bridges.

Table 2

With the scenario in place, the aircraft purchased, and the DPC scheduled, it was time to execute the mission. The first stop was the DPC. Since so many units of various sizes and compositions deploy from the European theater, USAREUR has established a permanent DPC located at Rhine Ordnance Barracks near Ramstein AFB. The purpose of the DPC is to ensure that unit vehicles and equipment are ready to deploy by air. Units arrive at the DPC with individual readiness training and personnel deployment processing already complete. The DPC is staffed by two sets of personnel: permanent party and a rotational "pusher" unit. Pusher-unit duties are tasked to the major subordinate command in V Corps. It was during the transition exercise between two pusher units that the battalion was able to fit into the DPC's hectic schedule.

The key to moving through the DPC smoothly was a well-prepared soldier who was qualified to handle hazardous materials (HAZ-12) and a unit movement officer (UMO). The first station (Station #1) of the DPC handles the paperwork for the vehicles: load plans, shipper's declarations, material safety data sheets, etc. The battalion's experienced HAZ-12 NCO, who had also served as the Station #1 NCOIC during the 565th's pusher-unit rotation, had all of the paperwork completed before arriving. It was also vital to have a UMO who had access to Automated Air Load Planners System (AALPS) software to complete the aircraft load plan. The battalion used the DPC's AALPS computer to input the load plan. The best scenario would have been to do this on the unit's own mobile computer, since it would have made things go more smoothly later in the processing.

Soldiers of the 38th and 320th Engineer Company FEMs prepare for takeoff in the C-130.

Although the paperwork portion ran smoothly, the other part of Station #1, where the load plans were verified, proved to be another challenge. The terrain-analysis FEM is designed around an M997 ambulance high-mobility, multipurpose wheeled vehicle (HMMWV). The purpose is to provide the FEM soldiers "office space" for their computer systems and high-speed plotters. Unfortunately, secondary loads need to be tied down in order to fly, and the inside of the M997 doesn't offer any tie-down points. The unit was finally able to secure the load, but good tie-down points are essential for the sensitive equipment that the terrain-analysis FEM uses. Since the same office space was not needed for the bridge-construction/ reconnaissance module, there were no tie-down issues for the M998 HMMWV used in that FEM.

Upon arrival at the "purple ramp" at Ramstein AFB for the Air Force joint inspection, the battalion was met with a

A K-loader is used to load the C-130 so that the HMMWVs can roll straight onto the aircraft.

few more challenges. The Air Force has different classifications for real-world missions and training missions. With those classifications come different requirements for paperwork and vehicles. For the Kosovo deployment scenario, the mission would have been considered a Chapter Three flight, which allows for three-quarters of a tank of fuel in the vehicles. However, since this was only a flight within Germany, it was classified as a special assignment air mission (SAAM)-channel flight—a routine flight. A SAAM-channel flight only authorizes half a tank of fuel in the vehicles.

The units had to drive back to Rhine Ordnance Barracks, defuel, and resubmit the hazardous-materials paperwork. This was the point at which the soldiers finally became aware that they were not actually going to Kosovo. Although disappointed that they were not deploying on a real-world mission, they were still excited to get the experience of going through all of the motions.

As loadmasters sometimes vary on their individual requirements, the aircraft load plans needed some adjustments. It took several tries to get the load plans to meet Air Force standards. At this point, it would have been beneficial to have the mobile computer with the AALPS on hand to make final adjustments to load plans, rather than relying on the DPC each time.

The biggest lesson learned from this deployment came as the vehicles were loaded on the aircraft. According to aircraft load manuals, loading an M997 ambulance on a C-130 requires a K-loader because of height restrictions. A K-loader allows the vehicle to be raised up like an elevator and driven straight into the aircraft. The problem lies in the fact that the FEMs are designed to deploy to undeveloped areas that will not have a K-loader on hand. After discussing the problem with the loadmaster during the flight from Ramstein to Rhein Main, he decided to try to unload the ambulance without the K-loader. It was a tight fit, but the ambulance unloaded on its own. However, the loadmaster explained that it may not fit on every C-130, and other loadmasters may not be willing to unload without the K-loader.

This was the first deployment test in the brigade for the FEMs. The 565th went through the complete process—from receipt of mission through all preparation-for-deployment stages to flying the FEMs to their mission site. The test provided vital information to be included in the 130th Engineer Brigade's FEM deployment standard operating procedure.

The deployment of a bridge-construction/reconnaissance FEM was successful; however, the battalion will now take another look at the working environment for the terrain-analysis FEM. As stated earlier, the original concept was to use the ambulance as office space. This would allow the terrain team to concentrate on its job rather than worry about setting up and tearing down tents. At this point, the battalion must find another vehicle that can be used as an office that fits on a C-130, modify the ambulance, or develop a FEM that operates from tents.

Though there are still issues that need to be addressed in the deployability of the FEMs, this was a great multiechelon training event and a valuable learning experience at all levels. It was an opportunity for all involved to sharpen their skills in deployment processing. In addition, the planning horizon for training versus operational deployments varies considerably. The battalion staff is now better prepared to plan for both. The lessons learned during this mission will be used in the planning of future deployment exercises for the remaining FEMs of the 130th Engineer Brigade.

Major Simon is the S3 of the 130th Engineer Brigade, Hanau, Germany. Previous assignments include S3, 565th Engineer Battalion, and assistant professor, United States Military Academy. MAJ Simon is a graduate of the Command and General Staff College and holds a master's degree in environmental engineering from Georgia Institute of Technology. He is also a licensed professional engineer in Virginia.

Captain Jeszenszky commands the 502d Engineer Company (Assault Float Bridge), 565th Engineer Battalion. Previous assignments include S3, 565th Engineer Battalion; operations officer, Directorate of Public Works, 6th Area Support Group; and S4, Engineer Brigade, 1st Cavalry. CPT Jeszenszky is a graduate of the Engineer Captain's Career Course and holds a master's degree in engineering management from the University of Missouri-Rolla.

The Evolution of the Engineer Force: Part I

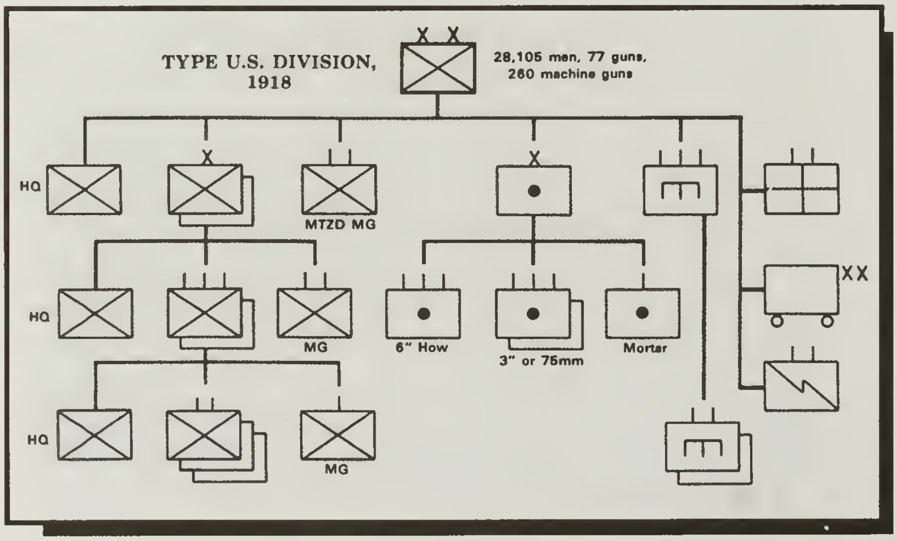
By Dr. Larry Roberts

While engineers have been a component part of the American Army since the days of the American Revolution, the force structure of the engineers, as understood today, is a 20th century phenomenon. The structure of the force has changed over the last 90 years in response to changes in doctrine, tactics, and national military strategy. However, the battlefield functions of engineers have remained constant. Indeed, the basic missions of engineers, or those performing engineering work, have remained the same since the dawn of organized human conflict. Simply stated, engineers facilitate the movement of the maneuver arms, obstruct or impede the movement of the enemy, and construct works necessary to protect and sustain the army in the field.

World War I

The basic structure of the modern engineer force dates from World War I. Before 1917, engineers were generally considered technical troops whose work largely focused on roads, fortifications, and facilities. Engineers were generally under the direction of the field army commander. Before World War I, there were only three engineer battalions in the Regular Army. In previous conflicts, such as the Civil War, engineer regiments—often volunteer organizations—were raised for the conflict and demobilized at the cessation of hostilities.

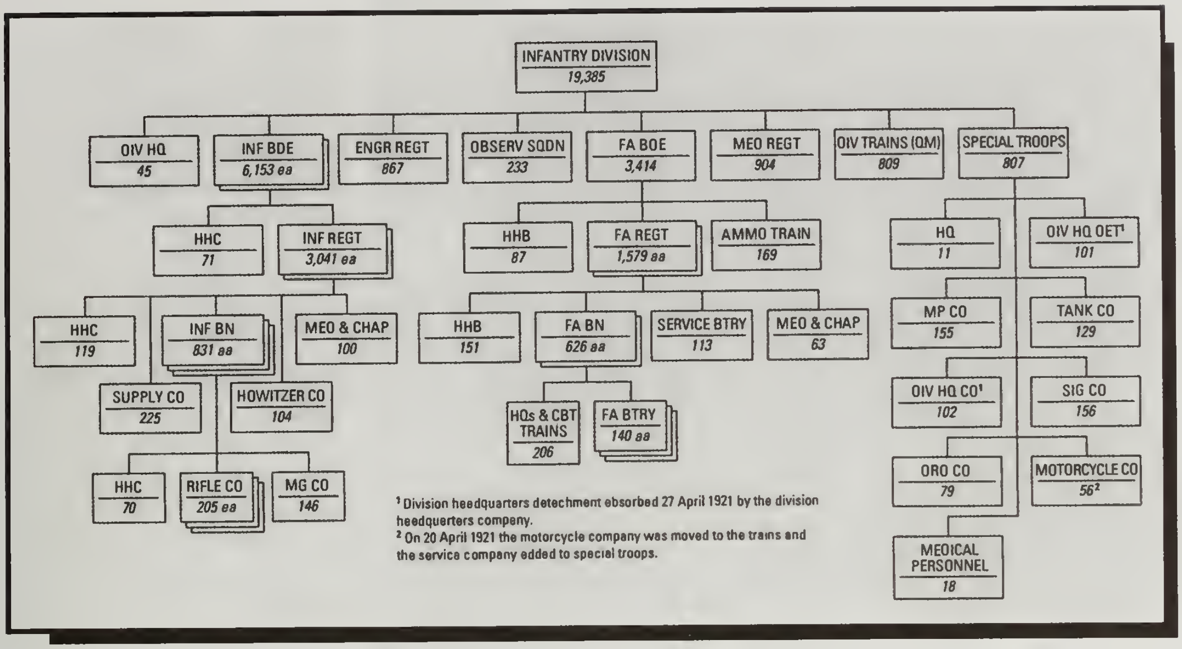
The driving force in changing this status was the advent of the combined-arms division. Before World War I, divisions were largely single-arm organizations, mostly infantry. Support units of artillery, and in some cases engineers, were assigned only as the tactical situation dictated. In 1911, the War Department began design work on a "maneuver division." The objective was to field a division comparable to those of European armies which contained all of the requisite combat, combat-support, and combat-service-support elements needed to fight as a self-contained force. The Corps of Engineers was heavily involved in this effort and ultimately recommended an engineer regiment for this division. By the entrance of the United States into World War I, this division had been tested and adopted as the standard tactical organization for war. Although adjusted by lessons learned in France during the war, this structure remained in effect for more than 20 years. Because the cornerstones of the division were four infantry regiments, the organization was referred to as the "square" division.



U.S. Army Divisional Structure - World War I

The engineer regiment assigned to this organization mustered 1,634 officers and men. In addition, the regiment had a trains section with an additional 84 officers and men who provided transportation, both horse-drawn and mechanical. The divisional regiment relied on picks and shovels for most of the engineering work performed. Building fortifications, constructing bridges, doing pioneer-level roadwork, and serving as the divisional reserve were the major tasks. The regiment consisted of two battalions with three companies each. The basic work unit in the regiment was the six-squad platoon. Each company had four platoons. This regiment was expected to perform all of the engineer work in the division sector.

Army planners, including engineers, did not have time before World War I to examine the proper composition of corps and armies. What emerged by 1919 was based totally on the experiences in Europe. Engineers and others quickly recognized the need for additional units at the corps and army levels. Two different types of organizations came into being. The first was a basic engineer labor battalion, referred to later as the separate battalion. These were largely work units comprised of black soldiers and white officers and NCOs. The second type of engineer unit was a specialized organization. The American Army in France ultimately had engineer railway, port-construction, forestry, mechanical, electrical, and depot units. As their names implied, these units concentrated on a particular aspect of general engineering



[1] Division headquarters detachment absorbed 27 April 1921 by the division headquarters company.

[2] On 20 April 1921 the motorcycle company was moved to the trains and the service company added to special troops.

Division Structure - 1920

in support of their corps or the army as a whole. The need for construction or sustainment engineering was so great that engineer railway regiments were among the first American troops to arrive in France.

The Interwar Period, 1919-1941

In the years following World War I, the Army—and by extension the engineer force structure—underwent substantial changes. In most instances, the changes were in the nature of reductions in the size of divisions and supporting units. These changes were prompted by several factors: First, the national military policy of the United States changed. Disillusioned by the Treaty of Versailles and the general outcome of the war, the American people turned their back on involvement in international affairs; isolationism became the trend. Consequently, the Army shifted its focus to defense of the continental United States and, to a lesser degree, its overseas possessions. Believing that the threat to the United States was minimal because of the ocean barrier, few individuals saw the need for a substantial military force. Hence, the Army was cut in both manpower and equipment.

Second, Army leaders, reviewing the performance of the American Expeditionary Force in France, believed that changes were needed. While the 28,000-man square division might have been appropriate for a war of trenches, "open warfare" called for a more mobile force. In this context, mobile meant the ability to move the division tactically and, to a lesser extent, strategically. Lacking shipping, the United States had been forced to send its units to France with little more than personal equipment and infantry small arms. Artillery, transport (both mechanical and animal), and other equipment were provided on the continent by the British and the French. At the tactical level, the movement of the large division constituted a transportation nightmare. The "road space" or transportation footprint of a division became a major factor for those planning future organizations.

The divisional structure was therefore trimmed in the 1920s and early 1930s. The overall strength of the division declined from the 28,000-plus World War I unit to an organization of slightly more than 19,000 in the 1920s. While some of the reductions were in the combat arms, a large part was in the combat-support units.

The Engineer Regiment was effectively cut in half. This reduction was based on two thoughts: First, the return to open warfare reduced the dependence on field fortifications, a major task of the engineers. Second, a division requiring less road space would have a reduced need for roads and the associated works such as bridges. Although a two-battalion regiment was retained, the number of platoons in each company was reduced from four to two. Similarly, the number of squads in the platoons was reduced from six to four.

Army planners essentially ignored the issue of organizational design for corps and army organizations. While war plans did call for a specific number of corps and army units, the functional organization of these units and their relationship to the maneuver division received little attention. The Corps of Engineers did examine the issue and changed the nature of its forces at echelons above division. Nondivisional units fell into one of two categories, general and special. The engineer general-service regiment and separate battalion were units that performed general engineer support functions for the corps and divisions, mainly road construction and maintenance. Special units included railway, topographic, heavy and light pontoon, water supply, and depot battalions and companies. Engineer doctrine projected that two-thirds of the field army's engineer force would be nondivisional in nature, either general or special.

Motorization and mechanization were supposed to reduce the need for engineers.

There were more organizational changes in the 1930s. The changes in the divisional structure in 1932 were comparatively minor. However, changes made at the end of the decade were significant. In 1935, the Chief of Staff, General Malin Craig, directed a review of the organization and tactics of the Army. Craig wanted to increase the tactical mobility of the division and incorporate new developments and technologies made in the areas of armor, motor vehicles, airplanes, communications, and weapons. For the next 5 years, the Army would wrestle with the organization of the division and the tactics it would employ in war. The advent of the German blitzkrieg in 1939 and 1940 hastened the work and forced the Army to finalize its design in 1940 and 1941.

For engineers, the issue revolved around the issues of tactical mobility, firepower, and armored protection. Many in the Army, primarily General Leslie McNair, believed that the modern division had to be light and highly maneuverable. Units not needed on a habitual basis would be withdrawn from the division and assigned to the corps. Improved cross-country mobility for fighting vehicles and even cargo trucks obviated the total dependence on roads. Proper reconnaissance, coupled with improved tactical mobility, would permit either the seizure of bridges before demolition or the determination of alternate routes when bridges were destroyed. A highly mobile force, especially one including armored vehicles, had little need for field fortifications or obstacles. Increased firepower, coupled with mobility, precluded the need for breaching forces, as the tactical unit would either go around established field fortifications or seize the ground before the enemy could emplace them.

These beliefs coalesced in the "triangular" division, a division with approximately 15,000 officers and men. The term triangular referred to the fact that the fighting strength of the division was found in the three infantry regiments, as compared to the four regiments of the square division. Divisional support units were either drastically cut or transferred completely to the corps.

Engineers fought a determined battle to retain a viable force for this new organization. Initial proposals called for a divisional engineer battalion of slightly more than 500 officers and men. At one point, however, the Corps responded to a subsequent proposal to reduce this to an engineer company of 175 officers and men. By 1940, the Corps had convinced the Army leadership that a battalion of slightly more than 600 officers and men was the proper unit for providing engineer support to the division. There were many engineers who believed that more engineers were needed. However, the leadership of the Corps adopted an approach of arguing for what they believed they could get, rather than what was needed. The divisional engineer battalion for the new armored divisions was slightly larger because of the addition of a bridge company.

The Corps was more successful in developing a viable engineer force at echelons above division. By 1941, the corps were authorized two combat regiments with 1,257 officers and men each. The mission of these two-battalion regiments was to perform all the engineering work in the corps area and, when needed, engineer work in the division area. The existence and size of these regiments was a concession on the part of the Army and the Corps that the divisional engineers did not have sufficient strength to accomplish all the engineering tasks in the division area. Corps combat units tended to have the same weapons as the divisional engineers but with more equipment. Doctrine generally oriented the corps engineer regiments to roads, bridges, and rear-area fortifications. Doctrine also called for the corps engineers to move forward to the front lines and provide direct support for division operations in cases such as river crossings.

The pre-World War II engineer force structure called for three general-service regiments, six separate battalions, and a number of special units, such as maintenance and supply companies, at the army level. The general-service regiments had slightly more than 1,200 officers and men and the requisite heavy equipment to perform the more substantial work needed on roads, bridges, and facilities. The separate battalions were as large in manpower as the general-service regiments. Ironically, the battalion's organization and functions were more closely related to the divisional combat-engineer battalion than other army-level organizations. As a matter of custom, the battalions were designed to augment the corps combat regiments as needed. Other engineer units at the army level included topographic, railway, pontoon, dump truck, depot, and maintenance units. Additional general-service regiments, separate battalions, and special units were authorized for the general headquarters (GHQ) echelon. In reality, this was the part of the theater of operations which contained the services of supply.

World War II

In May 1941, the Chief of Engineers, Major General Julian Schley, spoke to a gathering of the Society of American Military Engineers in Washington, D.C. He outlined the current status of the Corps and the strides that had been made in developing engineer organizations. Schley tried to ease the fears of many by saying that the advent of heavy machinery and power tools had more than compensated for the decline in the manpower in divisional units. This—plus the existence of an extensive engineer force at corps, army, and GHQ—meant that the engineers could meet the challenges of modern war. However, what Schley—and many maneuver commanders—did not recognize was that the modernization of the Army had in fact increased the engineer workload in war. The advent of armored forces increased dramatically the demand for stronger, more mobile bridges. The heavy cargo trucks adopted by the Army increased the demand for road construction, where roads were primitive or nonexistent, and road maintenance for existing routes. While trenches and associated field fortifications may have passed into history, they were replaced by mines and any number of other expedient obstacles.

Engineers responded to the increased demand for engineer troops by adjusting boundaries within the division, corps, and even army zones of operation. Corps combat units often performed work in the divisional area immediately behind the front lines. They also worked along with divisional engineers in operations such as river crossings and breaching operations. In fact, it became unwritten doctrine in Europe that actual river crossings and bridge construction would be done by corps engineers. This freed divisional engineers to assist the maneuver forces on the far shore. In Europe and the Pacific, a corps engineer battalion was habitually attached, and even located, in the divisional area. In certain operations, corps engineer support exceeded a single battalion. The 19th Engineer Combat Regiment provided the river-crossing support for the 36th Division during the crossing of the Rapido River in Italy. The 1171st Engineer Combat Group supported the 28th Infantry Division in its disastrous battle at Schmidt and in the Hurtgen Forest.

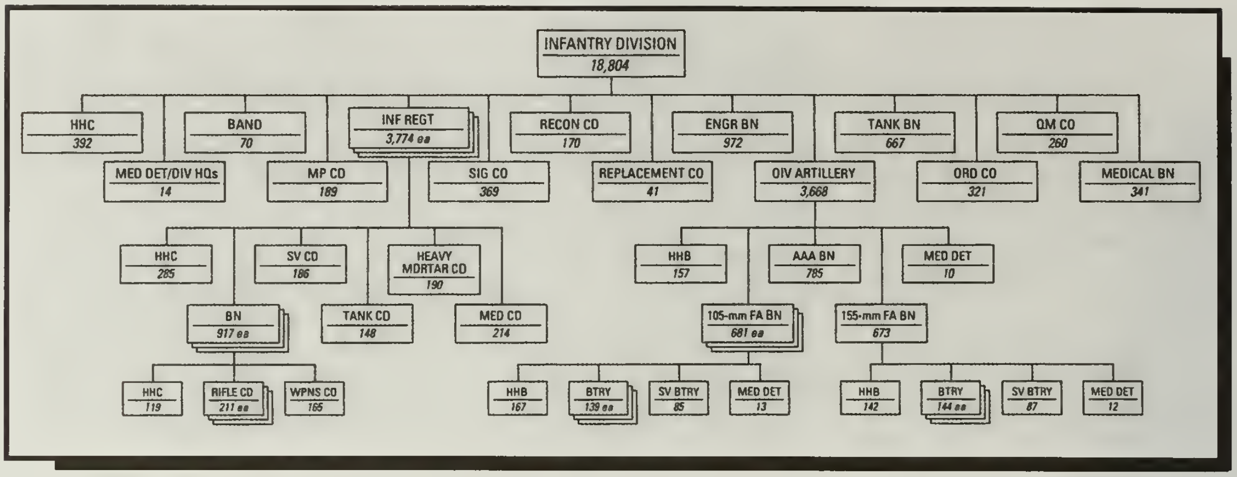
Dock and pier facilities in New Guinea, Southwest Pacific

This level of commitment to supporting the divisions often forced the corps engineer to ask for help from the army. Consequently, army engineer units, often general-service regiments, ended up working in the forward corps area. As might be expected, the army engineer called on the communications zone engineer for assistance in performing needed engineer work in the army area.

Following the war, the European Theater convened a general board to examine tactics and organizations with the objective of making recommendations for the postwar Army. The officers who examined engineer tactical policy noted, "The inadequacy of the engineer component of the division caused an abnormal forward displacement of engineers in all echelons." The published history of the engineers in the Southwest Pacific noted:

> *"The division engineer troop component of one combat battalion proved without exception to be incapable of providing sufficient close support for a division. It was grossly inadequate to meet the requirements imposed upon it by the tactical and technological conditions faced in the Pacific.... To provide the required engineer support, therefore, it became the standard practice to augment the engineer component of a division by attaching an additional engineer battalion from corps troops. This standard practice was followed, not alone in the interest of the engineers, but in compliance with the direct requests of army, corps, and division commanders who repeatedly recommended that a definite provision be made within the authorized organization of the division for this additional engineer battalion to permit continuity of training as well as employment."*

An analysis of the Army force structure showed that for every infantry or armored division, there were 1,668 combat-engineer troops and 2,276 support-engineer troops at corps, army, or the communications zone. The former were primarily in the combat battalions, the latter were in the general-service regiments,



Infantry Division Structure - 1948

and special engineer forces were operating well forward of the administrative and operational boundaries which defined division, corps, and army areas. In spite of this circumstance, there was no significant change in the structure of divisional engineers. The armored engineer battalion was reduced late in the war by the deletion of the bridge company, which was moved to corps control.

There were changes to the force structure for corps and army engineer units. In late 1942, the War Department started to convert nondivisional regiments to groups. Advocated by McNair, the argument was that the group was a more flexible command and control headquarters. Regiments were limited to their authorized battalions. Groups could control a varied number of subordinate elements. This would allow corps and army commanders to shift battalions and companies to areas where they were needed, while maintaining the continuity of the group headquarters associated with a tactical area. Engineer commanders generally considered this to be a bad idea. First, the regimental structure enhanced esprit and morale. Separate units, with little or no history, would be hard-pressed to establish this pride of unit. Second, the separate battalions had to have sufficient administrative and logistical personnel and transport to allow it to function independently. Providing these resources for battalions created larger personnel and equipment bills than was required under the regimental organization. These concerns, shared with many other branches, were generally ignored. Consequently, the corps engineer combat regiments were broken up in 1944, and their battalions were given separate numerical designations. Ultimately, general-service regiments suffered the same fate. The War Department also began transforming the large separate battalions to one or more standard engineer combat battalions.

A second change for the engineers involved a reorientation of engineer general-service regiments. While these organizations performed a variety of functions, the term "construction" tended to describe most of them. Consequently, engineer commanders, primarily in the Pacific, began to urge the redesignation of general-service regiments and battalions as construction battalions and groups. In the Pacific, the need to build most of the logistical and transportation infrastructure for American forces tended to focus army and corps engineers on this function. The process of redesignating general-service regiments and similar organizations to construction units had been largely completed by the end of hostilities in the Pacific.

As it had done in 1920, the Army examined its wartime structure in an effort to determine the most effective organizational structure for the postwar force. As has been mentioned, the general boards were created in Europe for this purpose. Although not formalized in boards, other theater commanders and their subordinate commands and staffs also forwarded recommendations. Senior engineer commanders were unanimous in recommending a return to the two-battalion engineer regiment for the division. They also recommended the return to the regimental structure for larger corps and army engineer units. Senior commanders in the Pacific noted that group commanders ended up devoting more time to the incoming or outgoing movement of separate battalions than they did the management and support of those under their control. Engineers in both Europe and the Pacific agreed that combat and construction units were the principal elements of the engineer force in war and that specialized units—such as topographic, maintenance, water, and depot—continued to fill a needed unique-mission requirement for deployed forces.

Engineer Force Structure, 1946-1950

The Corps was partially successful in convincing senior Army leaders that the engineer force of the field army needed significant increases. However, it was not successful in reconstituting either the two-battalion divisional engineer regiment or the regimental organization as a whole. This was in spite of the fact that the maneuver arms, principally the infantry, retained the regimental system for another 10 years. In 1948, the Department of the Army reorganized the infantry division, based on the experiences of World War II. Divisional engineer battalions were increased almost 50 percent. This was largely through the addition of a fourth letter company and the addition of a bridge platoon and an assault platoon to the headquarters and headquarters company. The armored divisional engineer battalion had a corresponding increase in personnel and equipment. With the addition of the fourth lettered company, the division engineer could allocate one company to each of the division's regimental combat teams and retain the fourth company for work within the division area. The fourth company could also reinforce one of the other battalions as needed. Doctrine at that time accepted that "In a major attack, the engineer battalion will normally need and receive assistance from a corps engineer combat group." This assistance could take the form of relieving the divisional engineers from other work in the division area or direct assistance in the attack itself.

A tactical bridge built across the Rhine River by a corps engineer combat battalion.

The divisional support role of nondivisional combat battalions was clearly evident in their organizational structure. The engineer combat battalion-army had 712 officers and men. It was similar to the divisional battalion with several important exceptions. First, the battalion had only three companies and lacked the bridge and assault platoons of the divisional battalion. It also had less construction equipment—such as road graders, cranes, and trucks—than the division. Clearly, the battalion's function was to reinforce the maneuver units. It lacked the equipment and personnel to perform substantial construction work in either the division or corps area. The construction-type work in the corps area—such as roads and bridges—was assigned to separate companies attached to the engineer combat group. These included dump-truck, light-equipment, and bridge companies.

There were no engineer units specifically assigned to the corps. All nondivisional organizations were assigned to either the army or the communications zone. The existence of engineer units at the corps meant that a number of organizations were "attached" to the corps as needed. Depending on the tactical situation and the units required, one or more group headquarters was attached to the corps to provide command and control. Existing doctrine did accept that on a normal basis, there would be two combat groups (each with three battalions and associated companies) per corps (of three divisions). This would allow the allocation of a battalion to each of the divisions, leaving the other three for work within the corps area. Not all nondivisional combat battalions or groups were to be found in the corps. Doctrine and force structures called for at least two combat groups (three battalions and supporting companies) per field army, in addition to the divisional and corps engineer units.

The construction battalion and groups were considered either army or communications-zone assets. Doctrine generally precluded their use in the corps and division areas. These units were responsible for the more permanent road, bridge, and facility work needed in the rear areas. The units were joined in army and communications zone areas by technical units such as port-construction, depot, and maintenance units.

At the end of the first half of the 20th century, the engineers had developed a force structure based on the lessons of two world wars. That structure had been tested in theaters of operation around the globe. The challenge for the second half of the century was to apply this structure and the associated lessons with conflicts short of conventional war. This was made additionally difficult as the Army increasingly looked to technology to solve battlefield problems. Equipment became systems and moved from being implements of war to the cornerstone of doctrine and force structure.

This is the first of a two-part article. Part II begins with force structure during the Korean War and continues through the 20th century, to include Vietnam, Desert Storm, and the Engineer Restructure Initiative.

Dr. Roberts is the U.S. Army Engineer School historian at Fort Leonard Wood, Missouri.

Officer PERSCOM Notes

Strategic Communication: The Army Knowledge Management Strategy

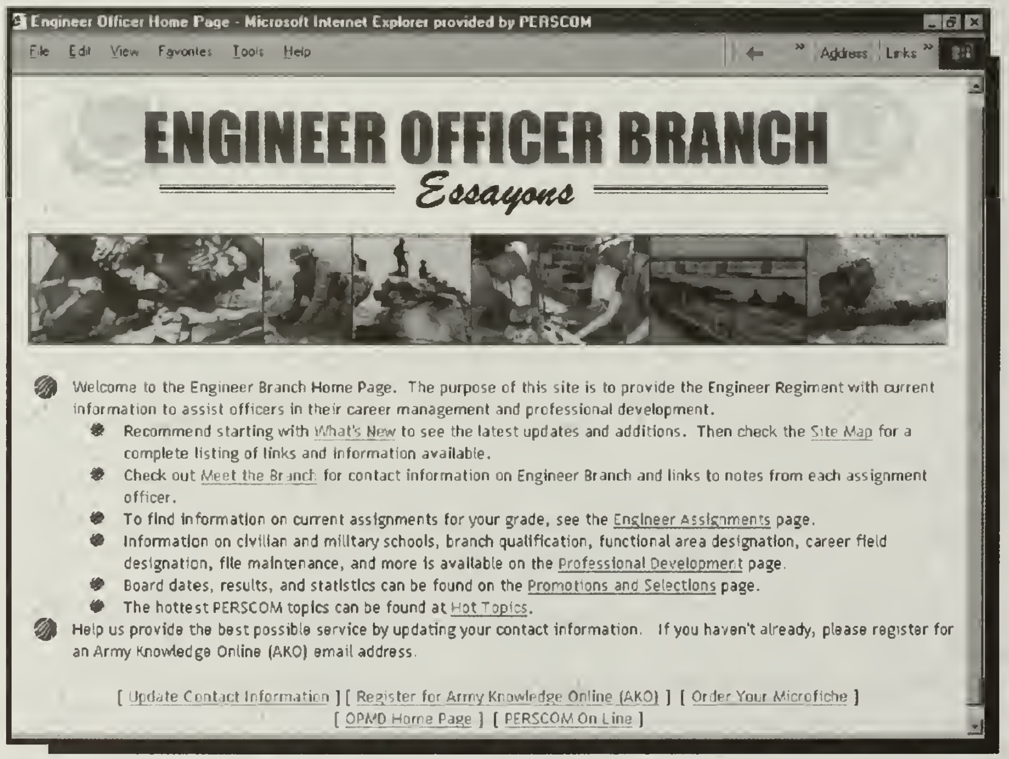
In August 2001, Secretary of the Army Thomas E. White and Chief of Staff of the Army (CSA) General Eric K. Shinseki signed a memorandum outlining the goals and direction for Army Knowledge Management (AKM), a strategy to transform the Army into a "network-centric, knowledge-based force." The center of this strategy is the Army Knowledge Online (AKO) portal. AKO is strategically changing the way we do business.

A main feature of AKO is the career lifetime e-mail. With an AKO account, e-mail can be accessed anytime from anywhere around the world. The user can forward messages from the AKO account to a different e-mail address—a regularly used one that is adjusted if the user moves or changes accounts. The AKO e-mail address remains the same no matter how many times the person moves or how many times his other e-mail address changes.

The lifetime e-mail feature is particularly useful for PERSCOM because it can maintain contact with officers in the field throughout their career. The CSA mandated that every soldier would have an e-mail address through AKO by 1 October 2001; however, less than 5 percent of engineer officers have an address on record at PERSCOM. You can help the Engineer Branch achieve this goal by sending us your AKO e-mail address today.

AKO has other services in the works. Soon, all soldiers will be able to review their Official Military Personnel File (OMPF), online, through AKO. Currently, majors going before the FY02 lieutenant colonel promotion board can review their files online. Accessing your files through AKO will eventually eliminate the process of requesting a microfiche, which can take weeks for a response. For more information on AKO capabilities and services, go to *www.army.mil/ako*. To apply for your AKO account, go to *www.us.army.mil.*

To support the CSA's strategy for AKM, the Engineer Branch has upgraded its home page to improve information distribution to the Engineer Regiment (see Figure 1). We have added assignment information, the Engineer Branch Brief, professional-development guidelines, frequently asked questions, and other useful information. At a minimum, we update monthly. Many of your questions can be answered by simply going to *www.perscom.army.mil/openg/enmainpg.htm.* Check the Web


Engineer Officer Home Page - Microsoft Internet Explorer provided by PERSCOM
File Edit View Favorites Tools Help
Address Links

ENGINEER OFFICER BRANCH

Essayons

- Welcome to the Engineer Branch Home Page. The purpose of this site is to provide the Engineer Regiment with current information to assist officers in their career management and professional development.
  - Recommend starting with What's New to see the latest updates and additions. Then check the Site Map for a complete listing of links and information available.
  - Check out Meet the Branch for contact information on Engineer Branch and links to notes from each assignment officer.
  - To find information on current assignments for your grade, see the Engineer Assignments page.
  - Information on civilian and military schools, branch qualification, functional area designation, career field designation, file maintenance, and more is available on the Professional Development page.
  - Board dates, results, and statistics can be found on the Promotions and Selections page.
  - The hottest PERSCOM topics can be found at Hot Topics.
- Help us provide the best possible service by updating your contact information. If you haven't already, please register for an Army Knowledge Online (AKO) email address.

[Update Contact Information] [Register for Army Knowledge Online (AKO)] [Order Your Microfiche]
[OPMD Home Page] [PERSCOM On Line]

Figure 1

site periodically to stay connected and informed. If you have suggestions for improving the home page, call the Web page manager at (703) 325-0766.

Lieutenant Colonel Assignments

Lieutenant colonels must know what they want to do and where they want to go before contacting the assignment officer. Their long- and short-term goals in those areas are important factors in determining assignments. A realistic assessment of promotion and command potential can save a lot of stress and frustration in the assignment process. The lieutenant-colonel population consists of about 420 officers who are managed based on lieutenant-colonel command potential. Assignments are based on which track an officer falls under: command or noncommand.

Command Track

Engineer lieutenant colonel commands are 24 months. Officers who are successful in command can expect to be assigned to a former battalion command (FBC) position. Conditions and priorities change, but typical FBC assignments include the Engineer School, Pentagon, PERSCOM, and Joint positions. About 90 percent of former battalion commanders will attend senior service college 2 to 3 years after completing command.

Noncommand Track

Officers not on the command track can expect to be assigned as a professor of military science; director of public works; deputy district engineer; instructor; staff officer for the Joint staff, Department of the Army staff, or installation or MACOM staff; or in multiple positions in the Active Component/Reserve Component (AC/RC). They are still competitive for promotion to colonel and should plan their career accordingly. Please contact the Engineer Branch for a file assessment.

Assignment Considerations

Officers should consider the following before talking to an assignment officer about their next assignment:

- Priority: location or position.
- Current time on station.
- Overseas vulnerability (6 to 10 years).
- Preference: short- or long-tour overseas.
- Personal desires and family considerations.
- Exceptional Family Member Program.

Army requirements have priority. However, the more an assignment officer knows about the individual officer and his/her family situation, the better the chances are that the officer's personal and professional needs will be met.

POC is Major Jeff Freeland, lieutenant colonels' assignment officer, Engineer Branch, OPMD, PERSCOM.

Major Assignments

Engineer majors are unique in the assignment process. Their time as a major is fast and furious, but if they maintain contact with their assignment officer and stay motivated, they can meet all requirements and remain competitive for lieutenant colonel. Department of the Army Pamphlet 600-3, Chapter 16, paragraph 16-3, d.(3) (a) specifies 12 months as the minimum required for branch qualification. However, recent board statistics place the average time for officers selected for promotion to lieutenant colonel far greater than the minimum. Our goal is to position engineer majors at locations so they get 24 months of branch-qualifying time. PERSCOM does not pinpoint officers to branch-qualifying jobs; it assigns officers to a MACOM, which will establish when an officer goes into a branch-qualifying job and in what unit that officer will serve. The key to ensuring that you get enough branch-qualifying time to be competitive for lieutenant colonel is to complete military education level (MEL) IV, either resident or nonresident, no later than 36 months before your lieutenant colonel promotion board. This allows the Engineer Branch ample time to position you at a location to get branch-qualified.

You are the best manager of your career. The Engineer Branch is here to assist and provide guidance. The PERSCOM and Engineer Branch home pages contain valuable information to assist you in this process. To help manage your career effectively, we must have current contact information, which includes home and work telephone number, home address, and an AKO e-mail address. Maintaining current contact information will also assist us with the assignment process. Assignments become available on a cyclic basis (see Figure 2, page 52).

As the Army continues to transition, engineer-assignment priorities will change to support this transition. Every officer should maintain situational understanding of the Army's future. The Engineer Branch will assist every officer with professional-development opportunities to be successful through this transition. Maintaining contact with us and staying informed of the Army's future will greatly assist in this process.

POC is Major Dave Holbrook, majors' assignment officer, Engineer Branch, OPMD, PERSCOM.

Captain Assignments

Following company command, an officer can expect to be assigned to a developmental position where there is an Army and engineer requirement for a branch-qualified captain. These positions range from an observer-controller or trainer at one of the combat training centers or in an AC/RC unit, to a company commander or operations officer in the U.S. Army Recruiting Command (USAREC). Opportunities also exist to serve in Reserve Officer Training Corps (ROTC) as an assistant professor of military science or operations officer and in the U.S. Army Corps of Engineers as a project engineer.

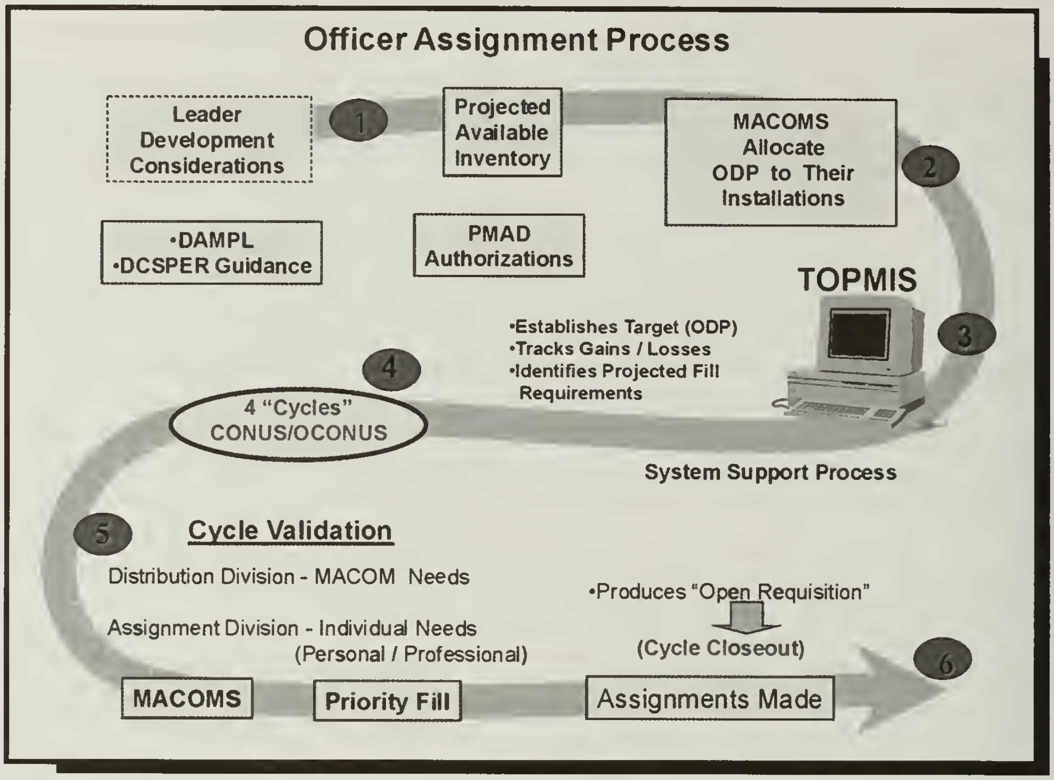

Officer Assignment Process
Leader Development Considerations
1
Projected Available Inventory
MACOMS Allocate ODP to Their Installations
2
•DAMPL
•DCSPER Guidance
PMAD Authorizations
TOPMIS
•Establishes Target (ODP)
•Tracks Gains / Losses
•Identifies Projected Fill Requirements
3
4
4 "Cycles" CONUS/OCONUS
System Support Process
5
Cycle Validation
Distribution Division - MACOM Needs
Assignment Division - Individual Needs (Personal / Professional)
•Produces "Open Requisition"
(Cycle Closeout)
6
MACOMS
Priority Fill
Assignments Made

Figure 2

Branch-qualified captains are a vital but short resource. Requirements for branch-qualified captains usually exceed the number of available officers. This shortfall of captains, coupled with the critical nature of the requirements, creates a level of anxiety for the officer being assigned and the assignment officer during the assignment process. Much of the anxiety is based on false perceptions in the field of common branch-qualified captain assignments.

The most common misperception is that a "3R" (AC/RC, USAREC, ROTC) assignment hurts an officer's potential for promotion, schooling, and battalion command. Almost 75 percent of branch-qualified engineer captain assignments are in this category, so almost every officer can expect a 3R assignment.

AC/RC and USAREC assignments foster the most concern from officers in the field; however, they are critical Army missions to which PERSCOM assigns the best officers. Congress mandates the filling of AC/RC units, and General Shinseki made recruiting his number one mission-essential task. Accomplishing the AC/RC and USAREC mission is vital for ensuring that our Army continues to fight and win the nation's wars decisively.

Three thoughts: First, 3R assignments are developmental positions that prepare an officer for increased responsibilities as a field grade. They provide an excellent opportunity to positively impact the future of our Army and Corps. Second, successful company commanders have proven that they can lead, train soldiers, and accomplish the mission. The challenge becomes sharing their experience with others so they may accomplish future missions for the Army. Third, if an officer is at risk for promotion, 99 percent of the time that risk was determined before or during company command. Rarely is the officer's current command responsible for the officer not getting promoted. Successful completion of company command is the best indicator of future success.

A 3R assignment itself has no negative bearing on promotion, schooling, and battalion command. Consecutive nontroop assignments, average company command OERs, and/or an overall center of mass performance will adversely affect potential. Therefore, it is important for the officer to do well in every job—for his and the Army's long-term success.

POC is Captain Ronnie Griffin, branch-qualified captains' assignment officer, Engineer Branch, OPMD, PERSCOM.

Enlisted PERSCOM Notes

By Lieutenant Colonel Peter Taylor

Greetings from the Engineer Branch. I appreciate the opportunity to update you on the health of the enlisted engineer force and trends I've observed since I assumed duties as Branch Chief this past summer.

Health of the Regiment

The Engineer Regiment, as a whole, is healthy. Today our Regiment is manned with 14 of our 21 military occupational specialties (MOSs) at 100 percent or better (see Table 1). I've been on the job now for more than 6 months, and I can tell you that no other branch enjoys this level of fill.

In the field, most units are filled at close to 100 percent. Typically, we see units filled with more skill-level-one soldiers and fewer sergeants and staff sergeants than authorized. The shortage of noncommissioned officers (NCOs), particularly sergeants and staff sergeants, is an Armywide issue caused, in part, by increased requirements for drill sergeants and recruiters. We also have several MOSs (00B, 51K, 51M, and 62F) that need more promotion-eligible specialists and sergeants to be boarded.

Despite our overall good health, we continue to experience shortages in a few of our low-density MOSs—00B, 52E, and airborne 62E/J. To address these shortages, we're bringing more soldiers into those MOSs, pushing for incentives to help retain more of those currently serving, and closely monitoring monthly promotion allocations. We also continue to accept reclassifications into these MOSs. Many of them offer attractive reclassification bonuses under the Bonus Extension and Retraining (BEAR) Program. Call this office if you're interested in reclassifying.

As a branch, we've accessed and retained well in recent years. Our recruiting successes can be attributed to the enlistment bonuses offered for some of our MOSs and to the fact that we offer challenge and variety for potential recruits. At this point in FY02, I'm pleased to report that we exceed the Army recruiting averages in all three of our career management fields (CMFs)—12, 51 and 81. Fortunately, we've been able to recoup the 12B accessions we missed earlier this year by adding enlistment bonuses and by increasing recruiter emphasis on the MOS. We see similar trends with retention. Reenlistment is strong in the 81 series, but CMFs 12 and 51 are retaining at levels slightly below the Army average. Again, we expect targeted incentives to help us meet our retention goals for the year.

The long-term projections for the Regiment are good, though we'll see our strength levels decrease slightly in those MOSs (12B, 12C, 51M, 51R, 51T) that are currently manned at better than 100 percent. This is necessary so that other MOSs, mostly nonengineer, can be brought up to strength. For every soldier in excess of authorizations in one CMF, there's a corresponding shortfall in another.

The Assignment Process

When I arrived, I was amazed to learn of the many factors that impact our ability to select soldiers for assignment—the Army Chief of Staff's manning guidance for units, individual qualifications and preferences, a soldier's permanent-change-of-station (PCS) eligibility (time on station, stabilization), and many more. I was impressed by the challenge our assignment managers and professional development NCOs (PDNCOs) face as they attempt to ensure engineer unit readiness while balancing a soldier's (and family's) preferences, professional development needs, and tour equity concerns.

MOS	Authorized Strength	Strength (percent)
12B	8,167	101
12C	658	116
12Z	228	100
00B	138	93
51B	881	119
51H	434	104
51K	115	96
51M	241	104
51R	128	159
51T	257	130
51Z	116	93
52E	185	82
62E	1,339	107
62F	280	94
62H	99	97
62J	705	97
62N	459	103
81L	247	119
81T	456	95
81Z	19	100
82D	110	115
Total	15,262	100

Table 1. Engineer Regiment MOS Strength

Given these considerations, you may wonder when you should speak with branch about your professional development needs and career aspirations. The answer, quite simply, is often and whenever you're eligible for reassignment. I recommend that you periodically call your assignment manager to initiate a dialogue and, when appropriate, follow up by submitting Deparment of the Army Form 4187, *Personnel Action*. More importantly, I encourage you to use the newly implemented Assignment Satisfaction Key (ASK) System which enables you to input duty preferences and locations directly to our database via the Internet. Our assignment managers now have the software to use your preference data when they fill requisitions—a great improvement to how we make assignments.

To better understand when you should speak with your assignment manager, it's important to know the timelines he works with and the factors he considers when making an assignment. Around mid-January, our assignment team started working assignments for fall 2002, more than 6 months out. Our standard is to place soldiers on assignment instructions (AI) at least 150 days before the report date at the next duty location. Assignment managers typically begin to work the preliminary paperwork several months before placing a soldier on AI. They need this time to screen records for nominative positions (drill sergeants, recruiters, observer-controllers, ROTC, AC/RC), obtain PCS/time-on-station waivers, research the availability of medical services to meet Exceptional Family Member Program needs, and so on. We usually fill drill sergeant and recruiter nominations 8 months before the anticipated report date.

For senior NCOs (sergeants first class and above), we work assignments even further out. Our goal is to place you on assignment instructions 12 months before your report date. This is a recent change on making assignments, so we're working toward the 12-month standard.

It's also important to know when your assignment manager will look at you for reassignment. If you're returning to CONUS, you can rely on the timelines described above to gauge when your next assignment will be worked—we seldom curtail soldiers before their DEROS. For those serving in CONUS, it's not uncommon to PCS with 24 months time on station, sometimes less. This occurs frequently for NCOs selected for drill sergeant and recruiter duty. Senior NCOs should expect that we'll work a follow-on assignment that coincides with their completion of 24 months in a leadership position (platoon sergeant or first sergeant). This doesn't mean they'll automatically PCS at this point, but we do consider them PCS-eligible once they've filled the leadership positions necessary for their professional development. That way, they'll stay competitive for promotion.

The bottom line concerning the assignment process is that we need to communicate with you frequently. Periodically call your assignment manager or PDNCO to review your assignment eligibility, preferences, and family circumstances. When you call, be realistic in your expectations. We can only send you to locations where your MOS is authorized, overseas assignments are a possibility if you haven't been stationed overseas in several years, and we probably won't send you on back-to-back assignments to TDA units. NCOs, at some point, you should expect to be asked to serve as a drill sergeant or recruiter or in an Active Component/Reserve Component (AC/RC) assignment. These are nominative assignments that our best NCOs are asked to fill—they are challenging assignments and are recognized by selection boards as being career-enhancing.

Board	Date	Target Release
CY01 CSM, SGM, and SMC	2 Oct – 24 Oct 01	Late Jan 02
CY02 MSG	5 Feb – 1 Mar 02	Late Apr 02
CY02 SFC	29 May – 27 Jun 02	Late Aug 02
CY02 CSM, SGM, and SMC	1 Oct – 23 Oct 02	Late Jan 03

Table 2. Selection Boards and Release Dates

Promotions and Training

Promotions and training are subjects that interest all soldiers. Two related areas that have recently received considerable attention are conditional promotions and NCOES attendance. As a reminder, conditionally promoted soldiers may lose their promotion if they don't attend the appropriate NCOES course (PLDC, BNCOC, ANCOC) when scheduled, typically within 1 year of being conditionally promoted. We can make exceptions for operational or hardship reasons; however, soldiers need to attend NCOES courses as soon as possible. Call this office if you have questions about NCOES attendance or conditional promotions.

Table 2 shows the latest projections for upcoming selection boards and release dates. Remember, it's up to you to review your Official Military Personnel File (OMPF) and get a current photograph submitted well in advance of your next board. Visit the PERSCOM Web site *(www.perscom.army.mil)* for the latest on selection boards and for procedures to request your OMPF.

Contacting Us

The Engineer Branch exists to support commanders and soldiers in the field. I encourage you to contact your assignment manager, PDNCO, Branch SGM, or me with any questions you have about your assignment or professional development—that's why we're here. The PERSCOM Web site has information on how to contact us. Remember, the best way to influence your future assignment is to tell us your preferences before we make your assignment.

Lieutenant Colonel Taylor is the branch chief for Engineer Enlisted Assignments.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

Army Development System (ADS) XXI. TRADOC hosted a workshop from 25 to 28 January 2002 to develop draft implementation plans for warrant officer and enlisted personnel. The workgroups identified unfinanced requirements for incorporation into the Planning, Programming, and Budgeting Execution System process for FY02 and the Program Objective Memorandum period FY03-08.

The agendas were as follows:

- Warrant Officer
  - Tailor technical training to unit and assignment.
  - Educate officers and NCOs on the role of a warrant officer.
  - Expand technical warrant officer accession base.
- Enlisted
  - Combining MOSs with similar functions.
  - Multiskilled soldiers.
  - Structured self-development.

POC is CW4 Frederick Kerber, 34088; DSN -4088; or e-mail *kerberf@wood.army.mil.*

MOS 51T Technical Engineer—a Feeder MOS Into the 210A Warrant Officer Program. See DA Pam 611-21, *Military Occupational Classification and Structure*, for a duty description of this MOS. For information on how to become a warrant officer, go to *http://leav-www.army.mil/wocc/.*

POC is CW4 Frederick Kerber, 34088; DSN -4088; or e-mail *kerberf@wood.army.mil.*

MOS 81T Topographic Analyst—Restoring Staff Sergeant Squad Leaders in Topographic Companies at Corps and Echelons Above Corps. The consolidation of MOS 81C cartographer and MOS 81Q terrain analyst into MOS 81T, along with changes in NCO strength, led to a reduction of 26 staff sergeant terrain-analysis squad-leader positions in engineer topographic companies (22 Active and 4 National Guard) to sergeant. In 2001, topographic unit commanders indicated a need to restore these positions to staff seargeant due to the complexity of the mission and the degree of responsibility required. The request to upgrade these positions is currently being handled through the military occupational structure process.

POC is MSG Arthur Harvey, 34087; DSN -4087; or e-mail *harveya@wood.army.mil.*

Standardized MOS Codes. On 24 January 2002, MG Anders B. Aadland approved a revision to the MOS coding of all officers, warrant officers, and enlisted soldiers in the Engineer Regiment. The codes were approved, in part, in December 2002 by the Deputy Chief of Staff, Personnel (DCSPER). The table to the right shows

OLD MOS	TITLE	GRADE	NEW MOS
Officers			
21A	Engineer general officer	1-6	21A
21B	Combat engineer officer	1-6	21G
21D	Facilities/contract construction management engineer	1-6	21D
Warrant Officers			
210A	Utilities operation and maintenance technician	1-5	210A
215D	Terrain analysis technician	1-5	215D
Enlisted			
Combat Engineer Career Field			
12Z	Combat engineer senior sergeant	8,9	21Z
12B	Combat engineer	1-7	21B
12C	Bridge crewmember	1-7	21C
General Engineering Career Field			
51Z	General engineer supervisor	8,9	21X
00B	Diver	1-8	21O
51B	Carpenter and mason	1-5	21W
51H	Construction engineer supervisor	6,7	21H
51K	Plumber	1-5	21K
51M	Firefighter	1-7	21M
51R	Interior electrician	1-5	21R
51T	Technical engineer	1-7	21T
51E	Prime power production specialist	5-7	21P
52G	Transmission and distribution specialist (Reserve only)	1-7	21Q
62E	Heavy construction equipment operator	1-5	21E
62F	Crane operator	1-5	21F
62G	Quarrying specialist (Reserve only)	1-6	21I
62H	Concrete and asphalt operations specialist	1-6	
62J	General construction equipment operator	1-5	21J
62N	Construction equipment supervisor	6,7	21N
Topographic Career Field			
81Z	Topographer engineer supervisor	8,9	21Y
81L	Lithographer	1-7	21L
81T	Topographic analyst	1-7	21U
82D	Topographic surveyor	1-7	21S

Note: MOS codes shown in red indicate a change from the 16 November submission.

the submissions from 24 January 2002, which may change. DCSPER may double-code two MOSs and areas of concentration because it is somewhat reluctant to use the O and I alpha characters. A decision should be made in 3QFY02.

POC is SGM Wade Kerr, 34087; DSN -4087; or e-mail *kerrw@wood.army.mil.*

FM 3-34.221 (5-2), *Engineer Initial Brigade Combat Operations.* The TRADOC commander has directed an acceleration of all Initial Brigade Combat Team (IBCT) doctrine manuals. The newly established date for completing the coordinating draft of this FM is September 2002. The manual will be used to prepare for the IBCT certification exercise in early 2003 and then finalized by November 2003.

POC is LTC William Duddleston, 37537; DSN -7537; or e-mail *duddlestonw@wood.army.mil.*

AN/PSS-12 Mine Detector DTLOMS Board. As part of the implementation of a DTLOMS board decision, portions of FMs 5-34, *Engineer Field Data,* and 20-32, *Mine/Countermine Operations*, are being revised to reflect approved changes to AN/PSS-12 training techniques. The updated methods, developed by Dr. Alan Davison, will be in change 1 to FM 20-32 and include modified sweep techniques, increased sensitivity checks, and detection training methods shown to raise the AN/PSS-12 detection rate of low-metal mines from 15 to over 87 percent.

POC is LTC William Duddleston, 37537; DSN -7537; or e-mail *duddlestonw@wood.army.mil.*

Countermine and Counter-Booby-Trap Center (CCBTC). Following the TRADOC commander's directive, the CCBTC was established at Fort Leonard Wood in January 2002 to create a dynamic learning center of excellence, able to forecast and respond to future developments in mine/countermine warfare before they are encountered by friendly forces. The center will draw on the resources of the Army, Marines, and intelligence and humanitarian mine-action communities so it can not only respond to current threats but also anticipate and meet future threats. The organization and mission of the center is being finalized following the Countermine Council of Colonels and General Officer Steering Committee in March and April 2002.

POC is LTC Mark A. Thompson, 37347; DSN -7347; or e-mail *thompsma@wood.army.mil.*

Humanitarian Demining Training Center (HDTC). The HDTC continues to serve as the U.S. DoD center for mine-action training. It offers the Humanitarian Demining Basic Course to soldiers who are deploying to support humanitarian mine-action operations. The HDTC also offers training in humanitarian mine-action management and new training to support soldiers conducting humanitarian demining oversight with the Stabilization Force. It is constantly updating its HDO course and collecting information from the field on humanitarian demining. Please contact the HDTC if your unit is scheduled to conduct a humanitarian demining-related mission.

POC is SGM Kevin Fee, 36199; DSN -6199; or e-mail, *feek@wood.army.mil.*

Engineer Captain's Career Course Schedule. Below are the dates for the course for the Active and Reserve Components:

Class	Report	Start	End
ECCC 3-02	03 May 02	06 May 02	11 Sep 02
ECCC 4-02	09 Aug 02	13 Aug 02	19 Dec 02
ECCC 1-03	29 Oct 02	12 Nov 02	03 Apr 03
ECCC 2-03	11 Mar 03	24 Mar 03	29 Jul 03

Class	Report	Start	End
ECRC 1-03	04 Oct 02	05 Oct 02	18 Oct 03
ECRC 2-03	25 Oct 02	26 Oct 02	08 Nov 02
ECRC 3-03	24 Jan 03	25 Jan 03	07 Feb 03
ECRC 4-03	21 Feb 03	22 Feb 03	07 Mar 03
ECRC 5-03	11 Apr 03	12 Apr 03	25 Apr 03

POC is MAJ Steve Cross, 34128, DSN -4128; or e-mail *crosss@wood.army.mil.*

Requests for Information (RFIs). RFI traffic in the division remains at an elevated level. Most questions center around airfield repair/construction and bridging. Division personnel instruct a wide range of subjects and have considerable experience and expertise. Please contact them with questions you may have related to construction engineering.

MAJ Chris Kramer, OIC and geology, 35372; DSN -5372; or e-mail *kramerch@wood.amry.mil.*

MAJ Isidro Rondon-Torres, bridging, 35660; DSN -5660; or e-mail *rondon-torresi@wood.army.mil.*

SSG David Lawson, bridging, 37552; DSN -7552; or e-mail *lawsonp@wood.army.mil.*

Kenny Light, civil engineering (roads/airfields), 35655; DSN -5655; or e-mail *lightk@wood.army.mil.*

Chad Morris, civil engineering (concrete/asphalt), 35653; DSN -5653; or e-mail *morrischa@wood.army.mil.*

CW3 Arthur Flinn, Warrant Officer Advanced Course issues and project management, 35537; DSN -5537; or e-mail *flinna@wood.army.mil.*

CW2 Greg Sanden, Warrant Officer Advanced Course issues and project management, 37788; DSN -7788; or e-mail *sandeng@wood.army.mil.*

SFC Franklin Bell, airfield damage repair (RRR), drainage, drainage structures, and horizontal construction, 35329; DSN -5329; or e-mail *bellf@wood.army.mil.*

SFC Thomas Hylsky, soils and site investigations, 35653; DSN -5653; or e-mail *hylskyt@wood.army.mil.*

SSG Mark Hackett, vertical construction/structures, 35639; DSN -5639; or e-mail *hackettm@wood.army.mil.*

SSG Jason Griffin, theater construction management systems, quarry operations, and horizontal construction, 35645; DSN -5645; or e-mail *griffinj@wood.army.mil.*

New Geospatial POC. CPT Ted Read is the new geospatial instructor. He recently attended the Topographic Officers Management Course and geospatial information and services training at Fort Belvoir, Virginia, to further his knowledge in terrain analysis. He is an instructor for the Engineer Officer Basic Course (EOBC) and Engineer Captain's Career Course (ECCC). You can contact him at 37060, DSN -7060, or e-mail *readt@wood.army.mil.*

Enhancements Within the EOBC and ECCC. The landmine warfare and demolitions and the tactics blocks of instruction have been updated. With the changes, students will be more knowledgeable on threat mines, booby traps, and countermine measures to defeat them in a contemporary operating environment.

POC for the EOBC is CPT Ken Boggs, 35593; DSN-5593; or e-mail *boggsk@wood.army.mil.*

POC for the ECCC is CPT John Clarke, 35582; DSN -5582; or e-mail *clarkej@wood.army.mil.*

Mine Cards for Afghanistan. The mine card deck for Afghanistan, GTA 5-10-51, *Afghanistan Land Mine Identification*, has been completed and should be available through your local Training Support Center.

POC is MAJ Mark Griffin, 36199; DSN -6199; e-mail *griffinma@wood.army.mil.*

Directorate of Training Development (DOTD)

Field Manual Update. The following field manuals have recently been sent to ATSC for print and distribution. Look for them in the near future on the Reimer Digital Library at *http://155.217.58.58/atdls.htm.*

- FM 3-34.343, *Military Nonstandard Fixed Bridging*. This is a complete revision of the June 1991 version.
- Change 1 to FM 5-499, *Hydraulics*. This is a one-page change, required because of incorrect information that could cause a safety concern.

POC is Sandra Gibson, 37651; DSN -7651; or e-mail *gibsons@wood.army.mil.*

Directorate of Environmental Integration (DEI)

Army Proponent for Environmental Integration. Because of the 1 December 2000 approved Army Environmental Campaign Plan and Operational Directive, signed by the Undersecretary of the Army and the Army's Vice Chief of Staff, the Engineer School was designated the Army's (and branch's) proponent for the integration of environmental considerations across doctrine, training (military and civilian), leader development (military and civilian), organization (design), materiel (requirements development), and soldier (and civilian) (DTLOMS) support and within military operations. DEI represents the Engineer School in the day-to-day execution of this mission. In this role, DEI will develop, integrate, evaluate, standardize, and synchronize environmental considerations into and across DTLOMS to increase awareness and knowledge of soldiers and civilians. The objective is to positively affect environmental efficiencies and effectiveness in conducting military training and operations. This will ensure sustainable Army training areas and ranges; environmentally considerate leaders, soldiers, and units when operationally deployed; and a program synchronized with the Army's other four areas of environmental concentration—research, development, and acquisition; installation management; operations; and public outreach. Additionally, the Engineer School (DEI) is charged with collecting and disseminating environmental lessons learned.

POC is COL Robert Kirsch, 34119; DSN -4119; or e-mail *kirschr@wood.army.mil*; or Dr. Rebecca Johnson, 34119; DSN -4119; or e-mail *johnsonr@wood.army.mil.*

Visual Archives. The History Office at the Engineer School is developing a visual archives. It currently has more than 18,000 photographs, largely from World War II and Korea. Units that would like to contribute photographs (copies) or other visual material should contact Dr. Larry D. Roberts, Historian, U.S. Army Engineer School, Fort Leonard Wood, Missouri 65473. Where possible, caption information should accompany the images. If you have questions, please call Dr. Roberts at (573) 563-6109.

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ENGINEER

The Professional Bulletin of Army Engineers

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Engineers Out Front!

Operation Enduring Freedom From the Military Engineer Perspective

Repairing Runways and Clearing Mines in Afghanistan

Updating River-Crossing Doctrine: Who and When?

ESSAYONS

Headquarters, Department of the Army
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U.S. Army Engineer School

573-563-8080 / DSN 676-8080

COMMANDANT
MG Anders B. Aadland
563-6158
aadlanda@wood.army.mil

ASSISTANT COMMANDANT
BG Randal R. Castro
563-6192
castror@wood.army.mil

REGIMENTAL COMMAND SERGEANT MAJOR
CSM Robert R. Robinson
563-8060
robinsonr@wood.army.mil

DEPUTY ASSISTANT COMMANDANT
COL John (Pat) Leake
563-8080
leakej@wood.army.mil

DEPUTY ASSISTANT COMMANDANT – USAR
COL Jimmy T. Fox
563-8045
foxj@wood.army.mil

DEPUTY ASSISTANT COMMANDANT – ARNG
LTC Robert McCabe
563-8046
mccaber@wood.army.mil

CHIEF OF STAFF
LTC Thomas E. O'Donovan
563-7116
odonovant@wood.army.mil

TRADOC SYSTEMS MANAGER for ENGINEER COMBAT SYSTEMS
COL John Holler
563-4081
hollerj@wood.army.mil

TRADOC PROGRAM INTEGRATION OFFICE - TERRAIN DATA
COL David Kingston
563-4086
kingstond@wood.army.mil

COMMANDER, 1st ENGINEER BRIGADE
COL James Rowan
596-0224
rowanj@wood.army.mil

DIRECTOR OF TRAINING
COL Jeffrey LaMoe
563-4093
lamoej@wood.army.mil

DIRECTOR OF ENVIRONMENTAL INTEGRATION
COL Robert S. Kirsch
563-4119
kirschr@wood.army.mil

DEPARTMENT OF INSTRUCTION
LTC Jeff Bedey
563-4129
bedeyj@wood.army.mil

CHIEF OF DOCTRINE
LTC Anthony Funkhouser
563-7537
funkhousera@wood.army.mil

HUMANITARIAN DEMINING TRAINING CENTER/COUNTERMINE TRAINING SUPPORT CENTER
Mr. Paul Arcangeli
596-3869
arcangelip@wood.army.mil

By Order of the Secretary of the Army:
ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:
Joel B. Hudson
JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0213703

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ENGINEER

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UNITED STATES ARMY ENGINEER SCHOOL

COMMANDANT
Major General Anders B. Aadland

MANAGING EDITOR
Lynne Sparks

EDITOR
Shirley Bridges

GRAPHIC DESIGNER
Jennifer Morgan

Front Cover: *A C-17 takes off at the Baghram airfield in Afghanistan.*

Back Covers: *Engineer soldiers*

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Clear The Way

By Major General Anders B. Aadland
Commandant, U.S. Army Engineer School

ENFORCE 2002 was another professionally rewarding opportunity to get together with all our Engineer leaders from around our Regiment. While it is always wonderful chatting with old friends whom we haven't seen for years, ENFORCE also gives us super opportunities to roll up our sleeves and, collectively, get down to the nitty-gritty of our Regiment's most important and pressing issues. If you recall, the theme for the ENFORCE 2002 Conference was "*Full-Spectrum Engineers – Force for Change.*" These words were chosen carefully; these words have great meaning.

Full-Spectrum Engineers means that we are providing, and will continue to provide, the entire range of engineering to the Nation—from combat engineering to construction engineering to geospatial engineering to environmental engineering. *Force for Change* means that the Engineer Regiment will aggressively lead the Transformation to meet the needs of the Army and the Nation. The "*Full-Spectrum Engineers – Force for Change*" theme continues in this latest issue of *ENGINEER*. In this issue, you will find important and particularly relevant articles on our Sappers out front in Operation Enduring Freedom (OEF)—to include repairing runways, clearing mines, and performing rapid airfield upgrade. Those of you still wondering about Transformation will find Dr. Larry Roberts' article "The Evolution of the Engineer Force: Part II" especially poignant. Engineers have always been in the forefront of changing to meet the needs of our maneuver brethren and the Army. The Sapper warriors of today *and* tomorrow must continue this. And in LTC(R) Anderson's article "The Real Army," he reinforces the fact that the most important part of our Army is people.

While the positive vibrations of ENFORCE have not worn off, we have had little time to bask in that sunlight; we have been deeply engaged as the Army's Transformation continues in high gear. Our Regiment is deeply involved in the training and development of the Interim Force and the conceptual development and planning for the Objective Force. Recently, we have made important contributions to the role of maneuver support in the Objective Force. On 29 May 2002, the MANSCEN Commandants (Chemical, Engineer, and Military Police) briefed the CSA and the DA Requirements Review Council (RRC) on the Objective Force Maneuver Support Concept. Now, maneuver support is one of the three key integrating areas of the Objective Force operational framework. As you know, these are extremely important efforts that we Engineers must pursue.

In the future and today, countermine remains one of the leading issues for our Army. This is particularly compelling for our forces engaged in Operation Enduring Freedom. We continue to work to develop solutions for the mine and booby trap problems around the world. We will continue to provide subject-matter expertise and mobile training teams to prepare our Sappers going into harm's way. We will also continue to develop and brief, at DA level, requirements for materiel and training to keep our forces mobile and safe and ensure that the Objective Force's combined-arms maneuver Unit of Action (UA) will be able to overcome this threat in stride.

As our Army continues to change, and with the personnel transitions that summer always brings, our Engineer School continues to change as well. To name a few of the key changes: we bid farewell and thanks to LTC(P) Gary Johnston, Senior Engineer, Directorate of Combat Developments (DCD); LTC Bill Duddleston, Doctrine Chief; and LTC Tom Chapman, Engineer School Chief of Staff. We extend a hearty "welcome aboard" to the inbound talent, including LTC Pete Tabacchi, new Engineer DCD Chief (moving over from DCD Concepts); LTC Bryan Watson, Engineer DCD Concepts; LTC Tony Funkhouser, Doctrine Chief; and LTC Tom O'Donovan, Engineer School Chief of Staff. These are your new Schoolhouse warriors. Add them to your list of key contacts. Put them to work. Send them cards and letters. Support them and count on their support. They will do great things for you and the Regiment.

It has been a tremendous honor for me to have served as your Commandant for the past two years. I appreciate the great teamwork and warrior spirit that you, as Sapper leaders of the Regiment, have demonstrated. With the rapid pace of change, this has been an exciting ride. But the pace will not slow down soon, and the new leader has stepped in to ensure that the important beats are not missed. We all extend our heartiest welcome to MG Bob Van Antwerp, your new Commandant. Van is a great Sapper warrior and leader who, along with BG Randy Castro and the outstanding Engineer School team, will accomplish much as the leader of this Force for Change. Welcome aboard, Van, and Godspeed as Sapper 6!

Essayons!

Lead The Way

By Command Sergeant Major Robert R. Robinson
U.S. Army Engineer School

I want to begin by thanking all of you who supported this year's ENFORCE Conference and made it such a great success. It was good to see all of the Regiment's leaders again, back here at the home of the Engineers, engaged in the shaping of our future in support of our transforming Army.

I especially want to thank the Sergeant Major of the Army (SMA) for taking time out of his arduous schedule to be a part of the Council of Sergeants Major. His presence during our conference was historic, and the insights he has on what's important in our Army, its future, and the initiatives being worked were of great value to us all. Some might believe that the position of SMA is one of merely a figurehead that symbolically represents the enlisted force. SMA Tilley demonstrates to the entire Army that he is much more than that. He tirelessly works a multitude of issues that guide the future of our Army and impact quality of life, training, and standards in an extremely positive way. He is genuinely committed to our soldiers and this nation and is a great credit to our corps of noncommissioned officers.

One of the aspects of ENFORCE that is extremely important to the future of our Regiment is the interaction that results when we all come together on common ground. This year proved to be very beneficial because we were able to extract recommendations on important issues such as professional and personal development for all soldiers, assignment and training considerations, promotion considerations, and force structure and equipment modernization. One area in particular was the feedback we collected and incorporated into the proponent guidance handbooks that we prepare for every centralized board proceeding. With the recommendations we received from the Council of Sergeants Major, we were able to make some last-minute updates to the FY02 Sergeant First Class promotion board, which convened on 1 June 2002. Although we will continue to review trends that affect promotion opportunities within the Regiment, it is important that all leaders review the proponent guidance posted on the Engineer School Web page and offer feedback on change.

Last year, we performed a groundbreaking ceremony for the Sapper Memorial as part of our ENFORCE Conference. During this year's conference, we announced the new location of the memorial and presented details on its construction. I am happy to report that construction will begin soon, and the proposed completion date is 17 August 2002. In addition, the Army Engineer Association has begun contract negotiations for the Sapper statue that will be positioned at the entrance of the facility. The memorial will be used for Rites of Passage ceremonies, among other Regimental events, and will be a great addition to the installation.

As you all know, the Army and this nation lost a great American and Engineer with the passing of SMA(R) Leon L. Van Autreve in March of this year. Those of you who knew Van (as his friends called him) know that he loved this country; was committed to soldiers, their families, and their quality of life; and dedicated his life to making a difference. He was a very respected, articulate, profound man whose love of life was infectious and transcended all he did and was a part of. In his memory, I have proposed that we honor an outstanding Engineer soldier, the same way we do the Sturgis awardees, and present an annual award, named after SMA(R) Leon L. Van Autreve, to our Regiment's most outstanding Active and Reserve Component soldier (PVT thru SPC). The Army Engineer Association has gained sponsorship for the award, and we will work diligently to ensure that it is ready for unveiling by next year's ENFORCE Conference. I have communicated with Mrs. Rita Van Autreve, Van's widow, and she is very supportive and excited about our desire to do this. The award will be a great honor to those outstanding soldiers who truly represent our Regiment in everything they do across our Army.

In closing, I want to impress upon you the importance of all the hard work you, your units, and your soldiers do, and the hard work that goes on here at Fort Leonard Wood. How vital what we do collectively is to the future of our Regiment and the Army! Engineers are literally everywhere, and the influence we have as a Regiment is evident all over the world. I am proud to have been an Engineer and a Sapper for more than 30 years. And I'm grateful for the experiences that being an Engineer has brought to me and that I have shared with many of you.

ESSAYONS—Engineers Lead the Way!

Operation Enduring Freedom From the Military Engineer Perspective

By Colonel Jerry T. Mohr, Lieutenant Commander Frederick A. "Fritz" Mucke, and Lieutenant Commander Donald L. Maconi

On 11 September 2001, U.S. Central Command (CENTCOM) Engineer Division, and its equivalent staffs within component commands, began the daunting task of directing military engineer efforts for a war unlike any this nation has ever faced. Operation Enduring Freedom (OEF) required engineers to support a unique contingency operation that required extraordinary resourcefulness. Key OEF activities requiring engineer support included contingency planning, engineer unit deployment, airfield repair and upgrade, mine and unexploded ordnance (UXO) clearing, troop protection from environmental hazards, and base camp construction. An obstacle to meeting these challenges was the need for staff augmentation. This article discusses these engineer challenges and some of the lessons learned from them.

Contingency Planning

As the dust settled from the 9-11 terrorist attacks, engineers immediately engrossed themselves in contingency planning. They evaluated the condition of available infrastructure in the area of responsibility and compared this information with engineer assets and capabilities, including those of several units already deployed in the Middle East Gulf region. This helped CENTCOM planners select force bed-down locations. Using this information, they oversaw the deployment of engineers supporting OEF operations.

Soldiers perform runway repair work at Baghram airfield in Afghanistan.

Engineer Unit Deployment

The initial deployment of OEF special operations forces into the area of responsibility did not include supporting engineer units. This shortfall became obvious as the demand for engineers quickly escalated. Some engineer forces already in the area revised their deployments to support early OEF requirements. One such example was an Air Force RED HORSE unit that diverted from a programmed project in one country to a contingency tasking in another.

As OEF progressed past the initial special operations force stage, the flow of forces into the area increased significantly. To support this, Air Force RED HORSE and PRIME BEEF, Army engineer and prime power, and Navy Seabee units received deployment orders to OEF contingency installations to repair and upgrade airfields, construct base camps, and provide electrical power. Army engineer detachments relieved Air Force and Navy Seabee units to continue base construction, maintenance, and repair. Engineers from several coalition partner nations also deployed into the area and supported runway-repair, well-drilling, and mine-clearing projects.

OEF engineer deployments overcame many obstacles to mission accomplishment. For example, limited construction materials and equipment hampered engineer missions. And additional short-fused taskings further strained engineer deployments, such as the construction of short-term holding facilities for detainees.

Yet engineers persevered with innovation and determination, using unique materials and techniques to compensate for resource shortfalls. For example, Navy Seabees at Camp Rhino, lacking equipment to clear foreign object damage debris, brought back to life an old Russian street sweeper from a local junkyard and used it to clear debris from airfield runways and taxiways. Once again, the engineer "can-do" spirit proved indomitable!

Airfield Repair and Upgrade

To support OEF in Afghanistan, warfighters needed airfields in several Central Asian countries surrounding Afghanistan and eventually within Afghanistan itself. These airfields would support fighter operations, logistical hubs, and force bed down. Because U.S. and Coalition forces had conducted only limited military operations in the region before 9-11, the only airfields and bases available quickly enough to support OEF were several fighter air bases of the former Soviet Union. The Soviets hastily constructed or expanded these airfields during their 1980s Afghanistan campaign. They used precast concrete slabs without rebar and emplaced them over graded ground without a subbase. Years of neglect and conflict, as well as OEF air strikes, had damaged and deteriorated the airfields and the supporting utilities and ground transportation infrastructure. Thus, engineers "operationalized" seven such former Soviet bases with significant infrastructure repairs and upgrades which established air operations for cargo (C-130 and C-17) and fighter aircraft.

A mine detection dog team proofs an area at the Baghram airfield.

Initially, rapid runway repair was the project du jour for engineers. They patched numerous bomb craters, repaired spalled pavement, and laid AM-2 matting to get airfields operational quickly. A more innovative technique was the Navy Seabees' use of "gorilla snot" palliative to suppress dust and stabilize soil for a desert dirt airstrip. But traditional concrete repair techniques necessitated closing sections of runways for days, while waiting for freshly placed concrete caps and patches to cure. Engineers discovered an alternative to conventional rapid runway repair that drastically reduced runway downtime—harvesting undamaged slabs from unused areas of airfields to replace damaged slabs. By replacing these slabs during several consecutive nights, airfields remained operational with minimal disruption while undergoing pavement repair.

The Air Force Civil Engineer Support Agency (AFCESA) performed pavement evaluation studies at each airfield. These studies provided analyses on airfield characteristics such as pavement strength and the number of passes a runway could endure before failing. The analyses also provided recommendations on runway, taxiway, and parking apron usage. Engineers used AFCESA studies to help determine the best use of limited engineering resources for airfield repair and maintenance.

Friendly forces are now using airfields used by our former adversary. Engineers have determined that in order to minimize the need to rework bomb crater repairs, future airfield strikes should avoid bombing the most critical sections of enemy runways—the landing touchdown and turnaround zones from either end of the runway for C-130 and C-17 aircraft.

Even after engineers made these airfields marginally operational, they contained preexisting environmental contamination, and the Afghanistan airfields remained laden with mines and UXO. So before the engineers could construct base camps by the airfields, they had to neutralize these hazards so the bases could support a significant population.

Mine and UXO Clearing

A common thread to every Afghan installation was the force protection requirement to "stay on the concrete" since mines and UXO littered each location. Although demining Afghanistan will be a separate long-term humanitarian-assistance initiative, OEF engineers had to immediately clear these hazards in areas where friendly forces were to live and work. In addition to the bed-down and operating areas, engineers cleared adjacent areas to achieve enough standoff distances for force protection.

Racing to stay ahead of arriving forces, U.S. military engineers initially deployed mine-clearing equipment and armor protection kits for bulldozers, along with operators and repair parts. Then several of our OEF Coalition partners stepped up to the plate, providing mine-clearing equipment, operators, and maintenance teams. As specialized equipment mechanically cleared these areas, contracted mine detection dog teams were used to proof the areas. The effectiveness of these mine-clearing assets allowed U.S. engineers to concentrate their efforts on tent city construction.

Environmental Engineering

During initial stages of OEF, planners faced time constraints and limited options regarding the selection of base locations, so operational planners were not always able to determine the extent of environmental hazards at an installation before deciding to deploy forces there. Ideally, environmental engineers perform baseline surveys within 60 days of deployment to operating bases to document preexisting conditions before U.S. forces arrive, but this was not always possible in OEF.

Engineers relied on the National Imagery and Mapping Agency (NIMA) to provide environmental assessments of potential operating bases, based on imagery analysis. NIMA assessments were sometimes the only source of environmental information available and were therefore invaluable to OEF planners.

Damaged asbestos roof tiles present an environmental hazard.

As U.S. forces flowed into these new OEF bases, some preexisting environmental hazards were discovered that could potentially impact ecological and human health:

- Petroleum-, oil-, and lubricant-contaminated soils—uncovered while constructing force protection berms.
- Exposed asbestos from damaged tiles and insulation—found while repairing and occupying existing structures.
- Low-level radioactive contamination—discovered in soil during earthwork.

Engineers used the U.S. Army Center for Health Protection and Preventive Medicine to help assess these hazards and develop mitigation actions.

Like any military operation, OEF generated significant quantities of hazardous waste (HAZWASTE), including used oil, dead batteries, and waste fuel. HAZWASTE-disposal contracts for the remote forward installations could not be awarded in time to eliminate the need to accumulate and store significant amounts of the waste at bases. It took 7 months to award a HAZWASTE-disposal contract to a qualified contractor and provide the required formal notification to countries receiving the waste.

Radioactive contamination was discovered during earthwork.

Base Camp Construction

As engineers made airfields operational and remediated mine/UXO and environmental hazards, their focus shifted to base camp construction to support the increasing flow of forces. They erected tent cities throughout the area of responsibility, using Harvest Eagle, Harvest Falcon, and Force Provider kits to support the ever-increasing force bed-down requirements.

CENTCOM engineers staffed and developed criteria for standardized guidance for planning and developing austere base camps and promulgated them in the "USCENTCOM Contingency and Long-Term Base Camp Facilities Standards." These standards will allow components to forecast resource requirements and provide tenant units with a common expectation for base camp construction.

CENTCOM Engineer Staff Augmentation

The CENTCOM engineering staff during peacetime is seven officers and one enlisted administrative specialist. With an OEF operational tempo of 24-hour days 7 days a week, the staff required augmentation from both mobilized Reservists and active-duty personnel on temporary duty.

Working through the J1 Directorate, the CENTCOM Engineer Division pursued staff augmentation. In addition to three assigned individual mobilization augmentee Reserve officers, CENTCOM executed its preexisting memorandums of understanding with service components for additional augmentees from both active and Reserve units. At the peak of OEF, the staff grew more than threefold. Work spaces became crowded, but the help was welcome.

Lessons Learned

During the first 9 months of OEF, the CENTCOM Engineer Division learned the following lessons on contingency engineering:

- Deploy more engineers earlier to support special operations forces and other operational units with equipment and skill sets to perform hasty construction. If such engineer assets could enter an area before the establishment of friendly operational airfields and without requiring helicopter support, they could quickly repair key airfields and establish air operations.
- Establish joint standardized guidance for planning and developing base camps, promulgated through a formal yet user-friendly document. It must be staffed and promulgated well before a contingency develops, so that components may quickly forecast resource requirements as a contingency kicks off.

A dozer operates in difficult Central Asian terrain.

- Engage environmental and preventive-medicine personnel early in planning and operations to assess the risks to ecological and human health and safety and mitigate them as much as possible.
- Initiate the HAZWASTE-disposal contracting process as soon as possible, so that these services are in place when needed to minimize operational constraints.

Summary

Engineers faced many challenges and learned many lessons from OEF. Some were typical of any contingency, while others were unique to OEF. Regardless, CENTCOM engineers successfully met the challenges and therefore contributed significantly to our successful and ongoing Global War on Terrorism.

Colonel Mohr served as chief of the U. S. Central Command J4-Engineer Division at the time this article was written. He previously commanded the 1AD Engineer Brigade. A graduate of the United States Military Academy, COL Mohr holds master's degrees in civil engineering from the University of Illinois and military arts and sciences from the Command and General Staff College.

Lieutenant Commander Mucke, Civil Engineer Corps, U.S. Naval Reserve, has several tours with Naval Construction Force (Seabee) units. He is currently recalled to active duty at USCENTCOM, Logistics Directorate, Engineer Division. LCDR Mucke holds a master's degree in environmental engineering from the University of Tennessee and is a registered professional engineer in Tennessee and Alabama.

Lieutenant Commander Maconi, Civil Engineer Corps, U.S. Naval Reserve, has served in several Naval tours as both an active-duty and Reserve officer. He is currently recalled to active duty at USCENTCOM, Logistics Directorate, Engineer Division. LCDR Maconi holds a master's degree in public administration from Troy State University and is a registered professional engineer in Florida.

The following people in CENTCOM Engineer Division were also involved in writing this article:

LTC Andrew W. Goetz, U.S. Army, Chief, Plans/Operations Branch

CDR Peter M. Hardy, U.S. Naval Reserve, Environmental Branch

LTC Allen E. Sosdian, U.S. Army Reserve, Plans/Operations Branch

MAJ Patrick J. Kelly, U.S. Air Force, Base Development Branch

LCDR Kurt R. Gies, U.S. Naval Reserve, Base Development Branch

YN1 Constance J. Paxton, U.S. Naval Reserve, Engineer Admin Branch

Repairing Runways and Clearing Mines in Afghanistan

By Major Dennis J. McNulty

Engineer forces are accomplishing a wide variety of tasks in support of Operation Enduring Freedom. In Afghanistan, they have often been called on to perform missions that are outside of their normal mission-essential task lists. They have built latrines and enemy prisoner of war (EPW) holding areas, repaired runways, cleared large areas littered with mines, repaired water wells, and designed wastewater systems. Castle wearers, regardless of their unit affiliation or normal area of expertise, are considered subject-matter experts in all engineering tasks. And engineer leaders at all levels still need to be "jacks-of-all-trades" to be effective on the modern battlefield.

Engineer units are learning valuable lessons in Afghanistan that should be examined for potential incorporation into future engineer doctrine, organizations, and materiel developments to enhance our current capabilities. And our engineers also acquired valuable information on the tactics, techniques, and procedures (TTP) required for clearing large areas that are heavily littered with mines and unexploded ordnance (UXO). This article will review the observations in these two areas and highlight lessons that were learned during a recent combined-arms assessment trip to Afghanistan.

Engineer soldiers place concrete to repair a runway.

Runway Assessment, Tracking, Repair, and Equipment

Overall, U.S. Army engineer units could repair runways with their organic equipment, but they learned some valuable techniques. In addition, the U.S. Air Force RED HORSE units and their British equivalents introduced our engineers to some equipment that is optimal for rapid runway repair.

Because of a lack of robust ground lines of communications (LOCs) in the area of operation, maintaining air LOCs is a priority throughout the campaign in Afghanistan. A critical mission for engineer units is that of repairing, maintaining, and upgrading designated airfields. The two primary runways in Afghanistan are located at Kandahar and Baghram. Army engineer units were able to keep these runways operating, but they discovered that effective runway tracking techniques had to be established to effectively monitor the rapidly deteriorating runways. Our engineers also discovered that their organic equipment was not optimal for conducting repairs.

Initial Runway Assessments

A team from the Air Force Civil Engineer Support Agency (AFCESA) conducted initial assessments of the airfields at Kandahar and Baghram. The teams generally overestimated the capacity of the airfields. For example, assessment of the Kandahar airfield was that it could support 50,000 passes by C-17s and 50,000 C-130 passes after several craters were repaired and that the Baghram airfield could support 15,000 passes by C-17s and more than 50,000 C-130 passes. When they received these reports, engineer planners were relieved that the airfields could support this amount of heavy traffic. However, for various reasons, neither of these assessments has been accurate. Once the initial repairs were made, the runways have continued to deteriorate to the point that they require daily maintenance.

The premature failure of the Baghram airfield can be attributed in part to several passes made by Russian IL-76 and AN-124 aircraft—the first being about the size of a C-17 and the second being among the largest airframes in the world. There was no projection to use these large airframes on the airfields, but there was no way to limit the use of large aircraft until the airfield failed and the Kabul airfield opened. The failure to support the number of passes at the Kandahar airfield may be attributed to an errant estimate during the assessment that the base was up to 12 inches thick when actually the runway had very sparse base material under some areas.

Had the AFCESA reports been available to Army engineer units before they deployed, the information would have helped the units prepare for their repair and maintenance missions.

Engineers construct a head wall.

Runway Tracking Technique

The method used for surveying and assigning priorities for repair on a given runway was simple but effective. Repair teams divided the runway into sections or grids, systematically numbered these sections, and then assessed the condition of each. Teams were assigned numbers or color codes that indicated each section's current condition. Sections with a number one or a red color had failed or were in poor condition and required immediate replacement. Sections assigned a two or amber color were in better condition but needed to be monitored for eminent deterioration. Sections with a three or a green status were generally in good condition and were in no danger of failing in the near future. The runways were monitored and reassessed periodically as they deteriorated. The Baghram airfield was constructed of 10-foot by 20-foot concrete slabs, so each slab became a monitored section. At Kandahar, the runway was surfaced with asphalt and was tracked using station numbers.

Runway Repair Technique

The Air Force and British runway repair teams used a "slab-harvesting" technique at the Baghram airfield. Small patches of damaged runway were cut out, the subbase was replaced and compacted, and the area was capped with undamaged slabs cut from unused areas of the runway or taxi areas. This technique required a large concrete saw—which U.S. Army units did not have—so they used precast slabs or placed concrete directly into the prepared section.

The aggregate to replace the base, or to make concrete if necessary, was procured locally. It was difficult to obtain early on because of the austere infrastructure and limited suppliers available, but this situation gradually improved. Type I cement was the only kind available in Afghanistan, so all Type III cement (needed for proper repair of the runway) and all cold patch (needed to repair the asphalt at the Kandahar runway) had to be flown in. Keeping an adequate supply of these repair materials on hand was a constant challenge.

Runway Repair Equipment

Three pieces of repair equipment were particularly critical when conducting the slab-harvesting repair technique: a forklift (for lifting and moving the replacement slabs into place); a concrete saw; and a small, highly maneuverable compactor. Since the U.S. Army units did not have the concrete saws required to cut concrete patches, they purchased two of them from the Air Force units when they departed.

The Bobcat® excavator was a very versatile and easily transportable piece of equipment. Small enough to be transported by a CH-47 helicopter as either an internal or external load, it was critical when repairs were needed at the airfield near Mazar-e Sharif, where fixed-wing aircraft could not land because of craters. In addition, a commercial ditching machine was useful for trenching in lighting cabling to make the runway operational at night and for digging in other cabling and sewage lines. The combat heavy engineer battalion purchased these two pieces of equipment before it deployed.

The Army's repair capability was further enhanced when it purchased a small, portable concrete vibrator; a walk-behind vibratory compactor; and an adjustable concrete screed from the Air Force. The Army units had manual hand tampers but found that the plate compactor attachments on the Bobcat were easier to use and quite effective. In addition, the Bobcat's pavement-breaking attachment was more reliable than the breaker on the 250-cubic-feet-per-minute (cfm) trailer and the small emplacement excavators. The sweeping attachment of the Bobcat was useful for cleaning the runway after repairs were made. The Army has a nonadjustable 20-foot concrete screed, and soldiers conducted manual screeding of repairs over 20 feet wide. The pneumatic concrete vibrators purchased from the Air Force provided more maneuverability and were more reliable than the ones for the 250-cfm compressor.

A larger issue with engineer equipment in Afghanistan was the number of aircraft sorties required to transport it into and within the theater of operations—nearly half of the sorties allotted to transport the entire brigade task force. It must be noted that the combat heavy battalion deployed with less than half of its assigned heavy-construction equipment. Had the airfields not been C-17 capable, moving the engineer equipment into Afghanistan would have been extremely difficult, if not impossible. As it was, several transloads were conducted, which resulted in separation of forces and equipment and delayed arrival of mission-critical pieces. Engineer equipment required 67 intertheater and 22 intratheater C-17 sorties to move into and around the theater.

Because of the complexities involved with air loading heavy engineer equipment, air-load planning is a must, even for units that do not traditionally move their equipment by air. Coincidently, the combat heavy battalion that deployed to Afghanistan had executed an air-load training event just before 11 September. In the exercise, the battalion loaded a dozer, a grader, a bucket loader, and a roller. Unit personnel became familiar with shoring and tie-down procedures for heavy equipment. The battalion was fortunate in that the theater airlift control element (TALCE), which was subsequently assigned to assist the battalion during the actual deployment, was the same team that had assisted the unit during the air-load training. This ensured the rapid and efficient deployment of the battalion because the TALCE unit was already familiar with the battalion's equipment.

Lessons Learned

- Leaders should carefully scrutinize airfield assessments as early as possible, especially when they are surprisingly optimistic.
- Army engineer units operating in areas that depend on air LOCs need to be highly trained and properly equipped to perform rapid runway repair techniques.
- Bobcats with appropriate attachments are highly effective for repairing runways.
- Concrete saws; small, maneuverable compactors; and a forklift are essential pieces of equipment for runway repairs requiring slab harvesting.
- Runway repair equipment should be small and easily transportable by helicopters or C-130s since the runway needing repair may not be open to large aircraft.
- Units should practice air loading their equipment, preferable with an available TALCE unit.
- Unit leaders need to ensure that their units have an adequate number of air-load planners and hazardous-material-qualified personnel for air loading their equipment.

Mine- and UXO-Clearance Operations

Engineer units were faced with the daunting task of clearing literally thousands of mines and UXO from thousands of square kilometers of ground to make the immediate areas safe for occupation and use by Coalition forces. The mine and UXO threat is extremely high in Afghanistan, particularly in the areas surrounding the Kandahar and Baghram airfields. An estimated 8 million-plus mines and UXO litter the countryside. The Soviets used antipersonnel (AP) minefields to protect the airfields and left them in place when they departed. These minefields were fenced and generally well-marked. Subsequently, however, the locals have lifted many of the mines and replanted them in areas outside of marked minefields. Both the Taliban and Northern Alliance forces are suspected of lifting mines and planting them in unmarked fields during their battles in and around the Baghram airfield.

Mines located in the vicinity include the PMN, PFM, POM-Z, TM-62, MON-50, MON100, TS-50, TC-6, and YM-1. UXO include AO-2.5 and PTAB-2.5KO, which are particularly prevalent, along with bombs with weights ranging from 200 to 500 kilograms. In addition, unexploded U.S. BLU-97s, which were dropped during early offensive operations, have been found. The U.S. forces that deployed were generally well-informed of the threat and the numbers and types of mines and UXO that they would encounter. At the time this article was written, there had been 10 mine and UXO incidents in Afghanistan, resulting in several deaths and severe injuries.

Coalition engineers and explosive ordnance disposal (EOD) units conducted clearance operations to make designated areas safe for use by Coalition forces. It is important to note that Title X, USC, prohibits U.S. soldiers from conducting humanitarian demining operations. Demining and area clearance differ in that area-clearance operations render an area reasonably safe for an operational use, while demining operations give a very high level of assurance that all mines and UXO have been removed from a designated area.

The procedures used to clear areas in Afghanistan were based on several factors, such as the estimated threat of encounters, the purpose of clearing, the type of terrain to be cleared, the type of clearing resources, and the time available. Generally, there were three methods of neutralizing mines in Afghanistan: manual, explosive, and mechanical.

Manual Clearing

The least preferred method, manual clearing involves manually moving or lifting mines or UXO out of the way. U.S. soldiers do not manually lift mines and, as this method involves the greatest amount of risk, it is not the preferred method of many Coalition force engineer units either. Lifting techniques are used to recover whole mines intact to use as training aides after they have been rendered safe. Mines that contain an explosive which remains stable over a long period, have a relatively stable activation mechanism, and are well-exposed are candidates for manual lifting. PMN mines were the most common manually lifted mines. The Norwegian engineer unit rendered several PMNs and PMN-2s safe in Afghanistan.

Explosive Clearing

Clearing mines and UXO with explosives involves placing the explosives in close proximity to the mines or UXO without disturbing them and then blowing them in place. U.S. Army EOD units and the Norwegian engineer unit also used a technique called small-arms UXO disposal (SMUD). While not technically an explosive method, this technique involves shooting the mine or UXO at a precise location. The intent of this method is to separate the fuse from the explosive material before the fuse can be activated; however, the munition often explodes during this process.

An MCAP dozer clears an AP minefield.

The preferred rifles to use with the SMUD technique are the .50-caliber Barrett rifle, the 7.62-millimeter M23 MKS sniper rifle, or the 5.56-millimeter M16 equipped with a scope. The munition must be clearly identified and exposed, and the shooter must know the preferred point of attack for particular munitions. The shooter also must know the blast radius and the general fusing and activation technique for particular munitions. Combat engineers in the U.S. cannot use this method because they are not equipped with SMUD rifles, nor are they permitted to dispose of UXO. Norwegian engineers effectively used this technique with the .50-caliber and 7.62-millimeter rifles. In addition, they have a special .50-caliber weapons station on selected M113 armored personnel carriers, which allows a slightly modified .50-caliber machine gun to be accurately aimed and fired from inside the M113 by using a telescopic camera site. The Norwegian engineers also were equipped with manportable ballistic shields, which they use to provide limited cover while engaging UXO.

Mechanical Clearing

Mine-Clearing Armor-Protected (MCAP) D7 Dozer. Two MCAP dozers with mine-clearing rakes were used in Afghanistan. To maneuver in tighter areas where only AP mines were suspected, one of the dozer's mine rakes was replaced with a standard dozer blade. The dozers either set off mines or windrowed them into berms without detonating them. The MCAP dozers were effective at clearing mines to a depth of about 6 to 18 inches (15 to 45 centimeters), depending on the soil conditions. The soil was usually loose enough to allow the dozer to clear to at least 12 inches. The MCAP dozer could withstand blasts from AP mines with little or no damage. However, the enclosed cab intensified the blast effects from detonation, and if operators detonated several mines in rapid succession, they had to be relieved because of the percussion effects they experienced.

The mine-clearing rake configuration was the preferred configuration since it was more likely to unearth and windrow the mines off to the side. In one clearing operation, the MCAP dozer equipped with the mine rake unearthed four antitank (AT) mines, which were daisy-chained together, without detonating them. The system worked as intended and lifted and pushed them off to the side. Soldiers from the combat heavy engineer battalion operated both dozers. The battalion received the armor kits just before deploying and permanently installed them on their dozers (a somewhat arduous task) once they arrived in theater. In another clearing operation, the MCAP dozers unearthed 14 AP mines and detonated 5 of them.

The armor plating of the dozers severely restricts the operator's vision so, during clearing operations, a ground guide is stationed at a safe distance to guide the operator and observe the spoil for unearthed mines or UXO. A disadvantage of the MCAP dozer is that after clearing an area, not only is the recently cleared ground susceptible to becoming a quagmire, but a berm which may or may not contain mines remains to be cleared later. Another disadvantage is that when fully equipped, the MCAP dozer can only be transported on a C-17 or larger aircraft unless it is disassembled and transported as several separate C-130 loads.

Flails. Three types of flails were used in Afghanistan. The Norwegians used the Hydrema 910 mine-clearing vehicle, and the Jordanians and British used the Aardvark mine-clearing vehicle—both considered medium flails. The United States had three miniflails.

Hydrema 910. This flail, which is C-130 transportable in its standard configuration, was used with great success. It is mounted on an articulating, wheeled vehicle which has one engine that provides power to the flail and one that provides power to the vehicle's drive train.

The Hydrema was particularly well-suited for the terrain and soil conditions in Afghanistan. The terrain was generally flat and the soil was generally loose silt and sand with occasional areas of hard-packed caliche. This flail detonated numerous AP mines and received very little damage; it also detonated a TM-62 AT mine with minimal damage. The Norwegians reported that they had successfully tested the Hydrema on mines as large as the U.S. M15 AT mine.

The Norwegians had two Hydremas in Afghanistan. They had modified one by installing oversized tires, which gave the

A mine detection dog and his handler proof an area.

vehicle better traction, especially in wet conditions. Under normal conditions, the Hydrema is set to clear to 18 centimeters (7.2 inches) below the surface, but it can clear as low as 40 centimeters (16 inches) at a much slower rate. The Hydrema's normal clearing rate is about 1,800 square meters per hour. In Afghanistan, the Hydrema had a high operational readiness rate, and the Norwegians came with spare parts, mechanics, and support equipment.

In addition to its slower clearance rate (compared to the MCAP dozer), a big disadvantage of the Hydrema, as well as other flails, is that the ground is left in a condition that allows it to turn into a quagmire with only a small amount of rainfall. Another drawback of the Hydrema was that it generated a cloud of dust. The direction of clearing was often determined by the direction of the wind, since the operator could not see when the dust blew back on the vehicle.

Aardvark. The Jordanians and British used the Aardvark to clear mines in much the same way as the Hydrema was used. The partially tracked vehicle, which gives it better traction in rough or wet terrain, experienced a somewhat low operational readiness rating for two reasons: repair parts were not readily available, and U.S. mechanics, who were unfamiliar with the Aardvark, were the only mechanics available to maintain it. Therefore, it was hard to ascertain if the low operational-readiness rating was due to the equipment reliability or if it lacked the proper repair support.

Miniflail. The U.S. engineers had three remotely controlled miniflails, but they were not very effective in clearing mines, mainly because they were underpowered. In one instance, the miniflail encountered two PMN mines—one failed to detonate and the other detonated and rendered the miniflail completely inoperative, making it necessary to extract it from the area. The consensus of observers was that they would not feel comfortable walking into an area where the sole clearance method was the miniflail. However, the small size of the miniflail made it ideal for clearing in tight areas around buildings or along trails. Because it can be transported in a CH-47 or sling-loaded under a Blackhawk, the miniflail concept is ideal for extracting soldiers from minefields.

Detection Means

Clearance operations generally depend on the ability to detect mines or UXO before they are encountered. Conceptually, if you can first identify the location of each mine or UXO, the risk to clearers is significantly reduced. Because the ground around the Kandahar and Baghram airfields was littered with all types of metal clutter, standard metal mine detectors were almost useless. So the primary methods of detecting mines and UXO were visual and with mine detection dogs.

Visual Detection. Many of the UXO were surface-laid and were easy to see in the sparse ground cover of the area. Most of the AP and AT mines, however, were buried and very difficult to see. In lower-threat areas, several Norwegian soldiers carefully walked the area and located surface-laid UXO before they flailed the area with the Hydrema. For obvious reasons, visual detection is the least preferred method. When the Norwegian engineers entered high-threat areas, they wore pneumatic air boots, which significantly redistributed their weight and reduced the per-square-inch pressure on the ground.

Mine Detection Dogs. Eight teams of dogs and their handlers were brought in from Bosnia and used successfully. The dogs alerted their handlers whenever they smelled a mine or UXO. Once alerted, the handler pinpointed the mine by visual means or by probing and then either marked or manually neutralized it as appropriate. On one occasion, a dog even located a UXO buried several feet below the surface. The dogs were generally used to proof areas to be used for troop bed-down facilities, after the areas were flailed or plowed with the MCAP dozer.

A drawback of using dogs for mine detection is that the method is significantly slower than mechanical methods. Dogs are also affected by environmental conditions. For example, hot weather limits the amount of time the dogs can work. As of mid-March, the mine detection dogs at Kandahar worked about 4 hours in the early morning and then again for a short period in the late evening. As the summer progresses and temperatures rise, the number of hours that the dogs can work each day will be significantly reduced—perhaps even to the point that they will be ineffective for clearing large areas. The temperature effects may not be as drastic in Baghram, where the higher elevation will keep temperatures moderate for a longer period.

For obvious reasons, extreme levels of dust negatively affect a dog's ability to detect mines. Also, recent detonations in an area render it unsuitable for using dogs for several days because the explosive material scents the area. The amount of moisture on the ground also affects the dog's ability to detect mines and UXO. As the ground dries, vapors from the explosives rise and concentrate above the munitions. Because of this, an optimal time to work dogs is shortly after a moderate rain as the ground is beginning to dry out.

The table at right summarizes the author's opinions of the advantages and disadvantages of the mine neutralization and

*Advantages and Disadvantages of Neutralization and Detection Methods

Neutralization Method	Advantages	Disadvantages
MCAP Dozer	- Has a rapid clearance rate - Clears AP mines - Clears subsurface, but has no depth control - Mechanically reliable - Clears rough terrain	- Leaves uncleared berms - Not C-130 transportable - Causes severe percussion if AT mine detonates - Makes ground susceptible to becoming a quagmire
Medium Flails Aardvark and Hydrema	- C-130 transportable - Offer depth control - Clear at a relatively rapid rate - Likely to withstand AT blasts	- Slower than the MCAP dozer - Cause a large dust cloud - Make ground susceptible to becoming a quagmire - Less effective in rough terrain
Miniflail	- Effective for mine extraction and MOUT areas - Highly transportable	- Allows minimal subsurface clearance - Has a slow clearance rate
Explosive	- Has a high probability of neutralization (if munition is seen) - Effective for point targets	- Not effective against buried munitions - Requires direct soldier exposure - Not effective for large areas
SMUD	- Requires no direct soldier exposure - Effective for point targets	- Requires special training - Requires special equipment - Requires pinpoint detection
Detection Method	Advantages	Disadvantages
Visual	- Easiest method - Can scan large areas	- Not effective for buried munitions - Only as good as the observer's visual acuity - Requires direct soldier exposure
Metal Detector	- Highly effective for high-metal mines and UXO	- Not effective with metal clutter or ferrous soil - Relatively slow - Requires direct soldier exposure
Mine Detection Dog	- Has a high success rate under ideal conditions	- Relatively slow - Affected by environmental conditions - Requires intensive training

* NOTE: The advantages and disadvantages shown above are based on the subjective opinion of the author and are intended to give the reader a comparative analysis of the various clearance methods used in Afghanistan. This is not intended to be a complete objective analysis.

detection methods used in Afghanistan. The table is not intended to be a complete objective analysis of clearance methods.

Clearance Tactics, Techniques, and Procedures

In areas where it was unclear if mines or UXO were present, the preferred method for initially clearing was the MCAP dozer or the flail. The overall clearing TTP used to clear large areas was usually to combine at least two or three detection or neutralization methods to increase the probability that no munitions remained. One example already mentioned was using the MCAP dozer or the flail in bed-down areas and then proofing the area with dogs. This procedure became a problem when the flail or MCAP dozer detonated a mine. Then the dogs could not be effectively used for proofing because of the scent from the explosion. In these situations, if time permitted, the dogs returned a day or two later and reworked the area. When time was short, the MCAP dozer was used, followed by a visual inspection of the area by engineers. In low-threat areas, the Norwegians walked the area to conduct a visual inspection, used the flail, and then reinspected the area.

Area-Clearance Tracking and Control

The task forces at each camp in Afghanistan effectively track area-clearance operations, but as of this writing, they had not established robust military mine action centers. These centers are needed to act as the single point of contact to collect information on the mine/UXO threat in the surrounding areas, coordinate area-clearance activities, prioritize areas to be cleared, and keep a single updated map and database that contain all mine-clearing operations.

At each base camp, engineers were responsible for tracking clearance operations and reporting which areas had been cleared and where mines and UXO had been located. They have made contact with the local demining organizations and have maintained good communications with these organizations. However, in some circumstances, clearance procedures are not being tracked in enough detail to allow the areas to be turned over to a humanitarian demining center upon conclusion of operations. To continue their operations, the humanitarian deminers need an exact description of the procedures and markings used in each area so that they can determine what further actions are required to certify that the area is cleared to

Tier III United Nations demining standards. As soon as possible after the immediate operational areas are cleared, mine-clearing participants need to meet and establish a military mine action center and ensure that procedures are established for reporting the current status and assigning priorities. The mine action center is responsible for establishing a master plan for clearing areas and for establishing standards for how these areas are to be cleared. Representatives from each clearance unit need to attend regularly conducted area-clearance meetings to report the current status, update the group, and review the current priorities.

Role of EOD Personnel and Sappers

An observation made regarding the interaction of EOD personnel and engineer units in Afghanistan was that most of our Coalition partners embed their EOD personnel in their engineer forces. And, in my opinion, some of the Coalition force engineers seemed to be more knowledgeable on threat mines and UXO and their internal workings than their U.S. counterparts.

On the ground, U.S. EOD personnel and engineers communicated well with each other and worked well together. U.S. EOD units called the U.S. engineers whenever they encountered minefields, and engineers asked for EOD support when they encountered UXO. An EOD representative was usually in contact with the engineer staff on a daily basis and, at Baghram, an EOD staff representative worked directly inside the engineer staff cell.

In some situations, EOD personnel were preferred over engineers when it came to destroying weapons caches because of a fear that the caches would be booby-trapped. U.S. engineers (12Bs) currently do not receive booby trap training in basic or advanced individual training. Likewise, U.S. engineer officers receive no training on booby traps in the Officers Basic Course or Engineer Captain's Career Course. The Engineer School is working to alleviate this situation by initiating a new booby trap familiarization course at Fort Leonard Wood, Missouri. The course—which will train students in the rudimentary elements of booby trap recognition, detection, reporting, and clearance planning—will greatly enhance any previous training that soldiers may have had. It must be emphasized that the course will not make the students "experts" at booby trap clearance—nor is it intended to. Booby trap clearance operations are inherently dangerous and, as such, should always be conducted with the assistance of EOD technicians.

Engineer soldiers build latrines.

Lessons Learned

- The MCAP dozer was an effective tool for clearing large areas, especially when the dozer was equipped with a mine rake.
- Installing armor plating on a D7 dozer was an arduous task and limited the dozer's uses for other missions.
- The Norwegian Hydrema was highly effective in clearing large areas.
- Norwegian engineers are equipped to conduct SMUD operations and have pneumatic mine boots, which they claim are highly effective.
- Mine detection dogs were effective at detecting mines.
- Units need TTP for establishing military mine action centers.
- U.S. engineers need booby trap training, need to be more familiar with the characteristics of various mines and UXO, and need to be prepared to react to mines and UXO properly when they are encountered.

Conclusion

Engineers at both the individual and unit levels are accomplishing a wide variety of tasks and missions in Afghanistan, many of which are outside their designated specialty areas or traditional missions. For example, light engineers built EPW holding areas, latrines, and guard shacks, while combat heavy units cleared large areas, conducted security operations, and made water wells and wastewater systems operational.

One thing was clear: engineers—no matter what their unit affiliation or normal area of expertise—were looked on as subject-matter experts in all engineering tasks. And it was evident that engineer leaders at all levels still need to be jacks-of-all-trades to be effective on the modern battlefield.

Major McNulty is the executive officer of the 577th Engineer Battalion, 1st Engineer Brigade, Fort Leonard Wood, Missouri. He was previously the operations officer, 5th Engineer Battalion, Fort Leonard Wood, Missouri. A graduate of the United States Military Academy, MAJ McNulty holds a master's degree in mineral economics from the Colorado School of Mines. He traveled to Afghanistan as a member of a Combined-Arms Assessment Team led by the Center for Army Lessons Learned, Fort Leavenworth, Kansas.

Combat Engineer Company Command and Control and the "Fighting 2IC"

By Captain Thomas Burton and Lieutenant Colonel Thomas H. Magness

Field Manual (FM) 71-1, *Tank and Mechanized Infantry Company Team*, provides the following definition of the responsibilities of the maneuver company second in command (2IC):

- Assist the commander with command and control (C2).
- Ensure that accurate, timely tactical reports are sent to higher headquarters.
- Conduct tactical coordination with higher, adjacent, and supporting units.
- Assist the commander in company troop-leading procedures.
- Prepare to assume command if necessary.

All of these roles are critical and are designed to do one thing—help the maneuver commander command his company. Without the assistance of the 2IC (typically the executive officer [XO]), the requirements and burdens of command in a warfighting scenario can be overwhelming. The 2IC is the commander's right-hand man—his wingman—with a similar fighting platform (tank or Bradley) to fight forward and help command.

Who fills this role in the combat engineer company? Rotation after rotation, battle after battle at the National Training Center, Fort Irwin, California, the answer continues to be the same—*no one*. Yet combat engineer companies are executing more combat missions as a warfighting headquarters—not simply as force providers and task-force-level staff integrators. We see engineer companies as the breach force in task-force-level breaching operations, engineer companies in direct support to the task force during defense-in-sector preparations, and an economy-of-force element to conduct shaping operations during movements to contact. With increasing frequency, engineer commanders are commanding their companies—but they are doing so without the assistance that their maneuver peers could not possibly fight without. The results, typified by the scenario in Figure 1, page 16, and amplified in the subsequent sections, include—

- Breakdown of C2 at the critical point of the fight—often the breach.
- Span of control issues—one leader working across the full width and depth of the task force's battlespace, orchestrating the combat operations for a variety of subordinate units with a variety of critical tasks.
- Minimal assistance provided to the commander during the planning, preparation, and preexecution phases of the mission.
- Reporting requirement—overload. One leader cannot be expected to manage at least three nets (typically engineer company command, maneuver task force command, engineer battalion command) simultaneously.
- Combat service support (CSS) issues—especially maintenance—often take "center stage" and become the commander's close fight.
- Succession of command—no one is prepared to take over the company should the commander be unable to continue.

> ***"In circumstances where experience provides few answers, commanders combine their experience, intuition, and judgment with the recommendations of the staff and subordinates to create new strategies."***
>
> ***FM 3-0, Operations***

The Dilemma

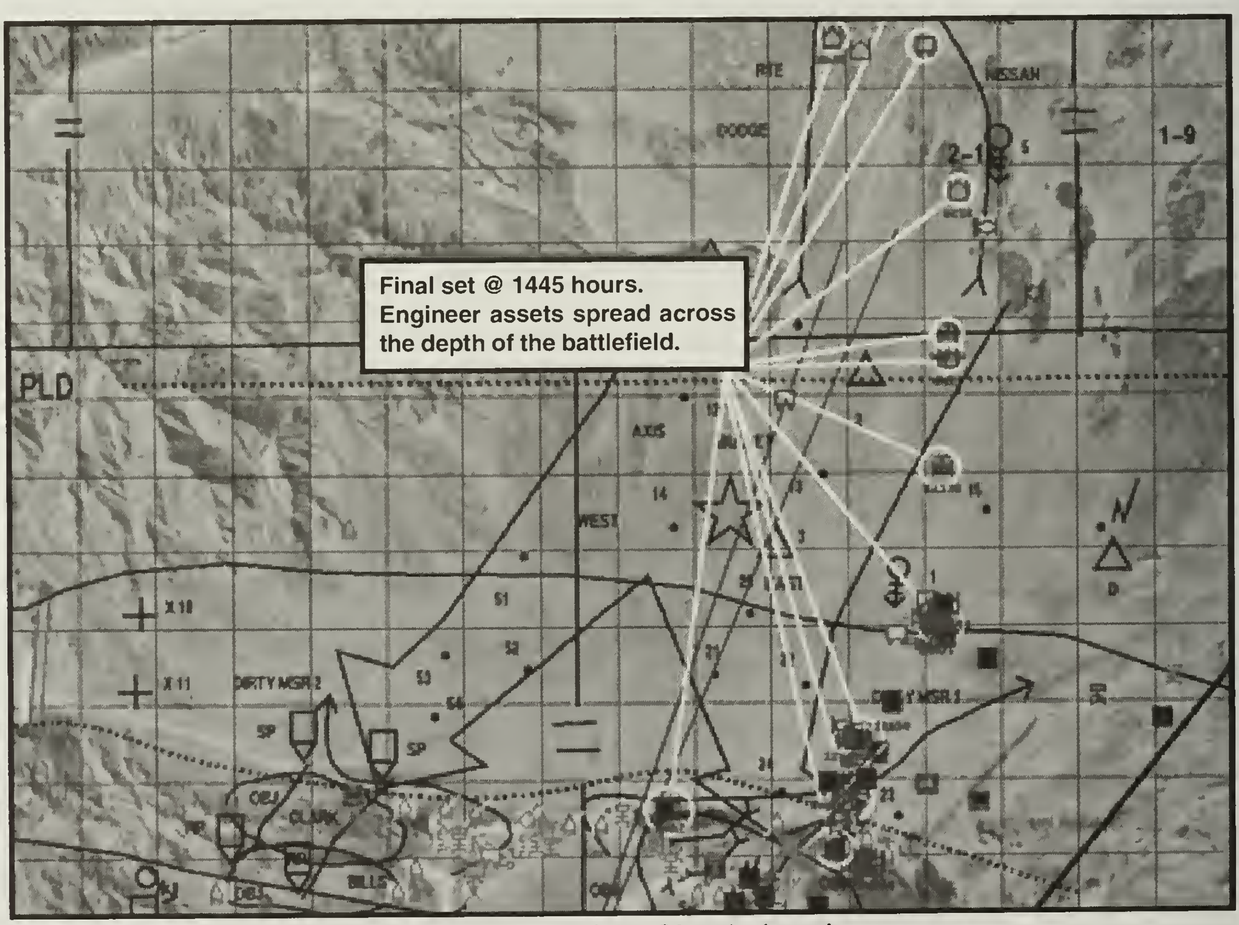
The National Training Center continues to highlight the following observations and trends with respect to engineer company C2:

Engineer Company/Teams

With increasing frequency, we are seeing a transition from engineer commanders functioning as task force mobility/survivability (M/S) Battlefield Operating System (BOS) integrators (dividing out resources and advising task force commanders) to warfighting company commanders in leaner (three maneuver companies under the Force XXI design) task forces.

In offensive operations, task force commanders are increasingly likely to leverage the capabilities and leadership of the engineer commander as a breaching or shaping force or a mobility reserve. During defensive operations, companies consistently fight pure, typically in direct support to maneuver units. Engineer transition into Bradley engineer fighting vehicles (BEFVs) will add combat power and capabilities to the task force that will make these arrangements even more likely.

During offensive operations, the engineer commander is more likely to serve as the breach force commander. As such, he is typically responsible for creating and marking lanes through or around obstacles, securing the nearside and farside of the obstacle, defeating forces that can place immediate direct fires on the reduction area, and reporting lane statuses/locations. The reverse breach planning process, outlined in FM 3-34.2, *Combined-Arms Breaching Operations*, often results in a breach force (the engineer company/team) with six or more platoons, each with unique capabilities. Figure 2 depicts one possible organization for actions at the most critical point



Final set @ 1445 hours. Engineer assets spread across the depth of the battlefield.

Figure 1. Breach force C2 at the breach

on the battlefield for an attacking task force—the breach. The engineer commander may have a tank or Bradley platoon to secure the point of breach, a mechanical smoke platoon to screen movement into and actions at the point of breach, two to three sapper platoons with attachments to reduce two lanes (with redundancy), and perhaps even a military police platoon to facilitate traffic flow around or through obstacles. The engineer company/team may also include an assault and obstacle (A&O) platoon tasked with mobility or countermobility missions, to include mine-clearing line charge (MICLIC) reload operations, lane improvement, Volcano emplacement, and other countermobility and survivability tasks associated with flank security or hasty defense.

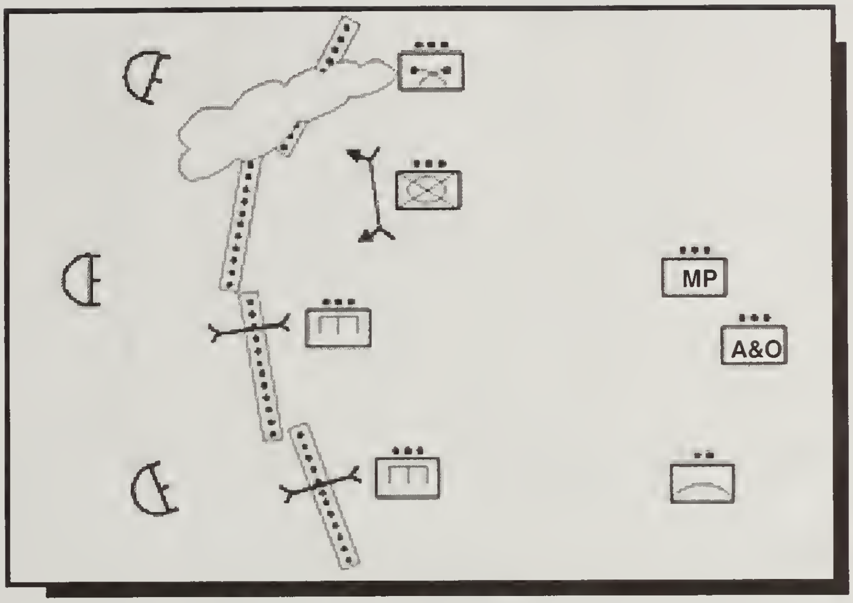


Figure 2. Breach force at the point of the breach

Is it any wonder that we continue to list breaching operations as the most complicated mission we ask our units to execute? By some measures, we have created a completely horizontal engineer company C2 structure that, in many cases, contributes to the complexities at the breach. Add to these the requirements to synchronize indirect and direct fires (attached maneuver or organic BEFV systems) at this critical phase of the attack, and the friction approaches chaos! In most scenarios, the commander must execute all of this without his own unique, appropriately positioned command post (his command post is tied into the task force tactical operations center [TOC] along with his company XO, wherever that may be) and no wingman!

Communications Overload

While the engineer commander fights his company, the task force and engineer battalion commanders are fighting their respective units and need continuous, accurate reports to be able to make decisions and keep their own higher headquarters informed. Typically this results in the requirement for the engineer company commander to monitor three FM nets (company command, task force command, and engineer battalion command) using only two radios. It cannot be done! Unfortunately, no one is forward with the commander to relieve him of some of these reporting requirements so that he can focus on his primary responsibility—fighting his company.

CSS Challenges

As engineer companies fight, they expend resources like any other unit—and things break. Whether accounting for the unique requirements of organic and attached units (M1 fuel, fog oil resupply, MICLIC reload operations, or even Stinger missiles), or keeping a firm hand on the readiness of aging engineer equipment, CSS is not a "change-of-mission" event. Unfortunately, the leader who is the primary CSS planner and maintenance integrator in most combat engineer companies in garrison (the company XO) is typically not available to help orchestrate these critical tasks during combat operations. Whether by design or by default, the engineer company XO is "locked" inside the task force TOC, leaving only the company first sergeant and the company commander to plan, prepare, and execute the critical "Paragraph 4" tasks. *WHERE IS THE HELP?*

Succession of Command

Who is the 2IC? Who has the situational awareness to take command should the commander be unable to continue? Who is positioned on the battlefield to be able to do this without losing momentum? Who has the fighting platform, the communications capabilities, the requisite leadership skills, and an adequate understanding of the plan to be able to "step up" if required? Answer—*no one*.

A Fighting 2IC

There are at least two possible courses of action (COAs), neither of which is easy nor perfect. Each has advantages and disadvantages and may require some "outside-of-the-box" thinking. Hopefully, the issues identified above are enough to make us all do so. Both COAs take into account that someone must fill the role of dedicated BOS integrator within the task force TOC—and someone *must* fill the role of 2IC.

COA 1

Use the XO as the fighting 2IC while moving the A&O platoon leader into the task force TOC to serve as the assistant task force engineer (A/TFE)/task force staff officer. The XO is the most senior and experienced lieutenant in the company, typically having served as a platoon leader and as a staff officer. The XO is already the company's chief CSS and maintenance planner and coordinator. He is the actual 2IC, already handles many of these 2IC duties when not deployed with the task force, and is arguably the leader most capable of assuming command when necessary. Observations at the National Training Center are that the A&O platoon leader is considerably

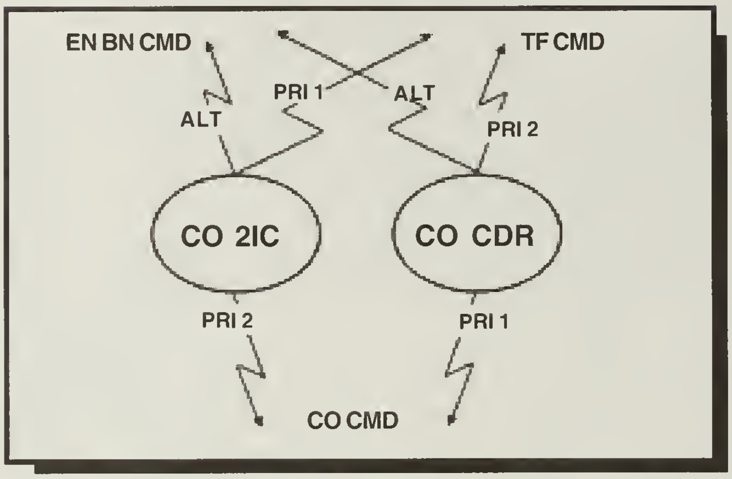


Figure 3. Commo configuration "A Way"

underutilized. His assets—M9 armored combat earthmovers (ACEs), armored vehicle-launched bridges (AVLBs), armored vehicle-launched MICLICs (AVLMs), and Volcanoes—are generally not working for him but are task-organized with one of the line platoons. What remains could be led by the platoon sergeant. We submit that the task forces will not, or do not, care who shows up as the A/TFE—as long as that person is a dedicated, competent engineer staff officer. The A&O platoon leader generally has an adequate understanding of his company's capabilities and should be able to work with the task force staff to integrate engineers and the M/S BOS into the task force scheme of maneuver. This is a paradigm shift, but a manageable one. (We said this would not be easy!)

COA 2

The A&O platoon leader serves as the fighting 2IC, and the XO stays in the TOC. This COA is clearly the easiest to implement. The XO continues to serve as most currently do, integrating the BOS at the task force level, while the A&O platoon leader, currently underutilized, is empowered to help the commander command. With respect to CSS, most maintenance issues within the engineer company are related to the A&O platoon, so its leader is already familiar with a large percentage of the critical logistics issues. However, the A&O platoon leader is not as experienced as the XO and is not the actual 2IC.

Discussion

The division of labor between the commander, fighting 2IC, and engineer BOS integrator (A/TFE) does not vary between either COA. While the commander still has overall responsibility for commanding the company and being a task force staff officer (task force engineer), he has a dedicated lieutenant to assist in each capacity. The commander gives the A/TFE guidance and direction for the integration of the M/S BOS into the task force scheme of maneuver. The 2IC has a primary focus of helping the commander command, assisting with leadership, discipline, employment, training, and sustainment of the company.

The engineer BOS integrator fights from the task force TOC. He assists the commander with the initial development of the engineer battlefield assessment, works with the task force S2 in developing the task force's situation template, and participates in the military decision-making process with the task force staff to help the commander integrate engineers into the task force's scheme of maneuver. He further assists with the preparation of the task force engineer annex, company operations order, and engineer logistics planning in the task force sector. He monitors engineer preparation and execution status as an integral part of the task force TOC.

The fighting 2IC is responsible for ensuring that accurate and timely tactical reports are sent to both the supported task force and engineer battalion. He conducts tactical coordination with higher, adjacent, and supporting units; conducts additional missions as required; assists the commander with troop-leading procedures; and, in conjunction with the first sergeant, plans and supervises the company CSS effort. During the fight, he assists with C2 and ensures that tactical reports are sent to both higher commands (task force and engineer battalion) (see Figure 3).

In both COAs, the A&O platoon sergeant must be prepared to take over the duties of the platoon leader in the field. The platoon leader serves either in the task force TOC (COA 1) or as the commander's wingman (COA 2). Most likely the senior and most capable of the available platoon sergeants in the company, the A&O platoon sergeant's role is primarily that of force/asset provider and CSS executor.

Benefits of the 2IC

A fighting 2IC provides value to more than just the engineer company commander. Reducing the number of tasks the engineer company commander must *personally* accomplish allows him to focus on the critical aspects of the company fight without sacrificing tasks critical to higher and adjacent units. While the commander may focus on critical planning/preparation issues such as company orders, precombat checks and inspections, and rehearsals, the 2IC may be tracking unit statuses, planning and coordinating company CSS efforts, and assisting in troop-leading procedures. Since the 2IC is familiar with the company scheme of maneuver that he helped the commander develop, he may be available to attend the brigade-combat-team (BCT)-level M/S rehearsal, freeing the commander to complete his company and task force combined-arms rehearsals—definitely a win-win scenario! During the execution phase, the commander can focus on the critical aspects of fighting his company. The 2IC pushes combat reports (yes, this is another paradigm shift—engineer companies pushing information!) to the task force and engineer battalion and coordinates supporting efforts such as mechanized smoke, air defense, or CSS, again allowing the commander to fight his company.

Similar to tank and mechanized infantry company 2ICs, our 2IC primarily focuses on integration with higher and adjacent units. Therefore, the task force and engineer battalion commanders get firsthand spot reports as the situation develops, regardless of how involved the commander is in the close fight. The improved situational awareness at task-force and engineer-battalion levels improves the abilities of both commanders to make decisions. The task force commander is better prepared to shift focus of supporting forces and commitment of assault forces. Even more time critical is the engineer battalion commander's ability to shift engineer assets across the BCT to take advantage of successes or react to a lack of success. Both higher commands can now make better and more timely recommendations to the BCT commander.

This delineation of duties frees the company first sergeant to focus on soldier preparedness. While the 2IC focuses on CSS planning and synchronization, the first sergeant is able to supervise the execution of CSS operations. He may also find more time to help the commander by supervising the company's execution of precombat checks and subordinate-unit rehearsals, in turn ensuring that the company is more prepared for the commander's inspections and higher-level rehearsals. Again, it is a win-win situation.

Conclusion

A fighting 2IC is a force multiplier for the engineer company, maneuver task force, and engineer battalion. He frees up the company commander to focus on the decisive point of the company fight. He provides firsthand tactical reports to higher headquarters regardless of how busy the commander is. And the fighting 2IC has the situational awareness to assume the fight if it becomes necessary.

To fully develop duties and responsibilities for the 2IC, we can start by looking at how tank and mechanized infantry companies utilize their XO. Thus, FM 71-1 is a point of entry for this analysis. For duties and responsibilities of the engineer BOS integrator (A/TFE in the task force TOC), the description in FM 5-71-2, *Armored Task Force Engineer Combat Operations*, remains an excellent guide. These duties and responsibilities could be refined and trained during officer professional development and company lane exercises, then confirmed during integrated combined-arms training exercises.

Each COA has relative strengths and weaknesses and is likely unit- and personality-dependent. We have not recommended a particular COA—just that you pick one. Hopefully, this discussion has convinced (or reminded) you that the C2 of combat engineer companies requires that someone fill the 2IC role. Decide who this person is; determine appropriate employment tactics, techniques, and procedures; and start practicing. The potential benefit to the company's warfighting capabilities and its integration within the task force and engineer battalion are too great not to move forward.

Train the Force!

Captain Burton is an instructor at the Infantry School, Fort Benning, Georgia. He previously served as an engineer company and task force M/S BOS trainer at the National Training Center and commanded Alpha Company, 317th Engineer Battalion. CPT Burton is a graduate of the University of Nevada and holds a master's degree in civil engineering from the University of Missouri.

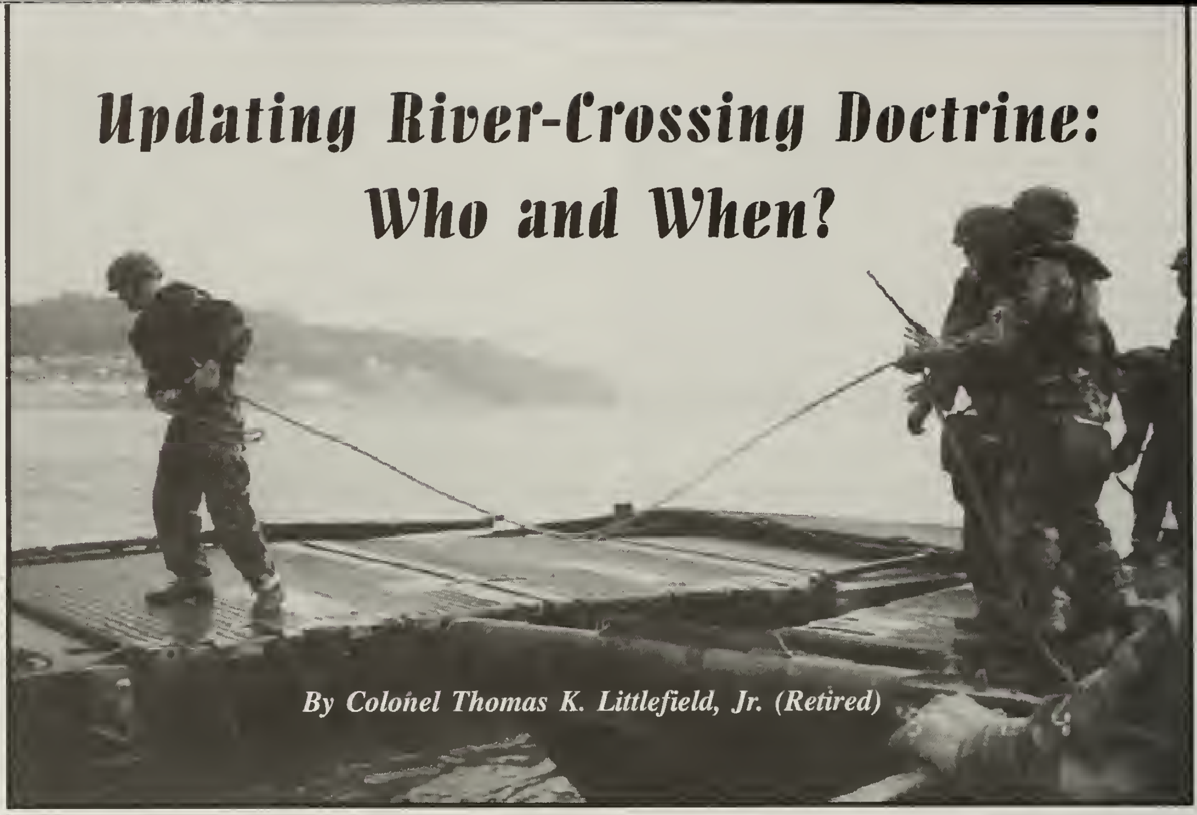
Lieutenant Colonel Magness is the Detroit District Commander for the U.S. Army Corps of Engineers. Previous assignments include engineer battalion S3 trainer on the Sidewinder Team at the National Training Center; brigade and battalion S3, 4th Infantry Division, Fort Hood, Texas; company commander, 16th Engineer Battalion, 1st Armored Division, Germany; and platoon leader and battalion staff officer, 17th Engineer Battalion, 2d Armored Division. LTC Magness is a graduate of the United States Military Academy and the Command and General Staff College and holds a master's degree from the University of Texas.

Parting Shots

As indicated in this article, no COA for how we implement this is easy—or perfect. It is worth concluding with some "unconstrained" tactics, techniques, and procedures for how we might implement this technique to maximize its potential:

- √ Identify the requirement for a dedicated engineer staff officer at the task-force level (like the S2 or the fire-support officer) and assign him to the maneuver headquarters for which he will work. Include the division cavalry squadron with this staffing requirement. M/S integration and terrain analysis are too critical to be available within the maneuver staff only as a function of task organization. We need to create the conditions where the commander is not forced to choose between BOS integration and command of his company. Both are important—and should be fully resourced.
- √ Adjust lieutenant career progression models to account for the critical assignment of M/S BOS integration. Currently, engineer officers spend almost no warfighting time between platoon leader and company command—if you accept the argument that A&O platoon leader (force provider), company XO (task force staff officer), and engineer battalion staff are not "trigger pullers." This is not unlike the artillery model—where lieutenants serve as fire-support integrators (company fire-support team) before moving to gun platoons. This gives lieutenants at least two warfighting assignments—platoon leader and company XO.
- √ Resource the 2IC with an M113 (and ultimately a BEFV). This obviously has huge implications. Is the appropriate number of Bradleys in an engineer company 9—or is it 10? We believe it is the latter—just as it is for tank (M1) and mechanized infantry (M2) units.

Updating River-Crossing Doctrine: Who and When?



By Colonel Thomas K. Littlefield, Jr. (Retired)

When I reviewed the first draft of Field Manual (FM) 3-93, *Decisive Force: The Army in Theater Operations*, one line early in the manual caught my attention: "As a doctrine-based organization, the foundations of the Army's doctrine for full-spectrum operations are found in FM 3-0 (formerly 100-5), *Operations*."[1] This made me think of three things:

- FM 100-5 was the capstone document for doctrine throughout my career. Its importance to winning the Cold War and many other hot conflicts, especially Desert Storm, cannot be underestimated. This quote about "doctrine-based organizations" and FM 100-5 reminded me just how important doctrine is. We are truly a doctrine-based organization and are only as good as our written foundation.
- Headlines in the *Army Times* stated, "Rock Bottom—Training Centers Report They Can't Meet the Mission"[2] and "Training Command the Hardest Hit in Manning Plan."[3] Our doctrine is written at the training centers. If they aren't supported, our doctrinal base will not be updated. We will be stuck on a single step in the never-ending staircase of military evolution. My concerns were confirmed when I called the Engineer School and learned that its doctrine cell consisted of three people and was being reduced to two in the near future.
- I encountered a doctrine problem in the 2d Infantry Division concerning river-crossing operations. The essence of this problem was rafts versus bridges.

Rafts versus Bridges

During my last assignment as the engineer brigade commander for the 2d Infantry Division, I was very fortunate to have a bridge company as part of the brigade. My previous engineer assignments were with the 25th Infantry Division and the 101st Airborne Division. In these light organizations, river crossing wasn't on our mission-essential task list, so we simply didn't train on it. The last time I planned and participated in major river-crossing operations was as a company commander in the 1st Armored Division during Reforger 79. During my four-plus years with this division, we conducted numerous river crossings. The primary lesson we learned with mobile assault bridges (MABs) and the "new" ribbon bridge was that you bridge as soon as possible. We rafted only when we couldn't get a bridge in quickly enough to support the maneuver commander's plan. There was some risk, but it was offset by the much greater buildup of combat power afforded by bridges. During Reforger 79, we went straight to bridging. Our combat power built up and quickly overwhelmed the opposing force—1st Tank seized and maintained the initiative until the end of the exercise.

At the 2d Infantry Division, I ran into the doctrinal problem of rafts versus bridges. During a planning session, I commented that as a general rule I recommended rafting only when there were not enough assets to build a bridge. The response was, "This isn't our doctrine; we raft to build initial combat power and then transition to bridges." We discussed that the decision to bridge immediately was a situational decision based on the calculus of combat-power buildup and the level of risk the commander was willing to accept. Even so, my audience still believed that rafting operations are a necessary part of doctrinal river-crossing operations. They provided direct quotes from FM 90-13, *River-Crossing Operations*, to support their argument.

In reviewing FM 90-13, I discovered that there were very few references to immediate bridge construction. They were limited to the following:

"Commanders may consider immediate construction of a bridge during this phase (Phase II - Assault Across the River)

without ever conducting rafting operations. The advantage is that the combat power can be massed on the far shore at a much faster rate. The risk that the commander takes in making this decision is that a larger amount of bridging assets is exposed to enemy fire before the elimination of enemy indirect fires on the crossing area."[4]

"Since vehicles cross rivers much faster on bridges than on rafts, early bridge assembly is desirable but must be weighed against the risk that the enemy can still bring indirect fires down on an immobile bridge."[5]

References on the need for rafting were much more numerous and included the following:

"Bridges replace or supplement rafts once enemy-observed indirect fire is eliminated."[6]

"The urgent need to get tanks across the river means the rafting stage often begins before terrain on the far shore is secure to the planned (release line) *RL."*[7]

"Heavy rafts are prepared to transport tanks and infantry fighting vehicles to the far shore for reinforcing the dismounted infantry."[8]

"Enemy indirect fire into the crossing area will probably continue; however, each crossing site within the crossing area must be isolated from direct fire to enable the construction and operation of rafts. These rafts will then be used to transport armored vehicles for rapid reinforcement of the dismounted infantry task force."[9]

"Rafts are usually the initial means for crossing non-swimming vehicles—particularly tanks—on wide, unfordable rivers. It may be possible to bridge immediately after the assault across the river; however, rafting is normally first because rafts—

- *Are less vulnerable to enemy air and indirect fire due to their size and maneuverability.*
- *Are quicker to assemble.*
- *Offer more flexibility in operation, particularly in site selection and subsequent movement between sites.*
- *Can use existing road networks and banks where access and exit routes are not aligned opposite of each other."*[10]

Consider the following—

" A river crossing is a race between the crossing force and the enemy to mass combat power on the far shore. The longer the force takes to cross, the less likely it will succeed as the enemy will defeat, in detail, the elements split by the river. Speed is so important to crossing success that extraordinary measures are justified to maintain it. The commander must allow no interference with the flow of vehicles and units once the crossing has started."[11]

The calculus of force buildup is greatly enhanced by immediate construction of bridges if the situation allows. To close a 150-meter gap on the Imjin River, where we routinely trained, with one construction site took about 90 minutes. At this point, we could begin crossing vehicles at the rate of 200 an hour. If we initially built the two rafts that can be accommodated with a single centerline on a 150-meter gap, we could cross 14 M1 tanks in 95 minutes.

Five minutes after the bridge went into operation, it began to exceed the crossing capability of the rafts. It could cross 33 vehicles every 10 minutes versus the two vehicles crossed by the rafts. This is a significant payoff that must be considered and not ignored due to the wording and structure of our doctrine. (See the table on page 22 for the vehicle-crossing timelines.)

Members of the 50th Engineer Company "Bridge the Gap!"

Number of Vehicles Crossed											
Minutes	25	35	45	55	65	75	85	95	105	115	125
Two Rafts	1	2	4	6	8	10	12	14	16	18	20
Bridge	0	0	0	0	0	0	0	16	49	82	115

Why doesn't our doctrine explain how to compare bridges to rafts and definitely say that going immediately to bridges is a serious option? My initial thoughts were that we were still using doctrine based on old time-intensive bridge systems. As a platoon leader, I had experience in building Class 60 and M4T6 rafts. For trained troops, building a Class 60 raft capable of carrying an M60 tank took 50 minutes if the pontoons were preinflated and combat-loaded and 90 minutes otherwise. For the equivalent M4T6 raft, it took 100 minutes.[12] For both types of bridging, it took 3 to 5 hours to build the 150-meter bridge required for the Imjin River example.[13] I believed that since it took so long for bridge construction, these bridge systems forced us to initially build rafts. This suspicion led me to the Military History Institute, where I reviewed all available river-crossing publications beginning with one dated 31 January 1941 to the present one dated 26 January 1998.

As I reviewed the various manuals, I was surprised—especially by the post-World War II publications. The manuals of the 1940s depended heavily on various rafts with the standard rafting operations followed by bridging operations. The first field manual I found that was totally dedicated to river crossing was FM 31-60, *River-Crossing Operations*, dated August 1952. Based on the date, I assumed that it incorporated lessons from World War II and the initial lessons from the Korean War. Following are some of the more interesting quotes:

1st Brigade, 2d Infantry Division, crosses the Imjin.

"While it is desirable to delay [bridge] construction until the construction site is relatively safe from observed artillery fire, the responsible commander must evaluate the effect of delaying erection on his mission against losses of trained personnel and equipment."[14]

"The following factors must be considered before heavy-bridge construction is ordered:

(1) The mission.

(2) The tactical and logistical support required by forces on the far side of the river.

(3) The amount of available and reserve bridging.

(4) The accuracy and intensity of enemy air attacks and artillery fire on the bridge site.

(5) The probable danger of loss of the bridgehead if sufficient armor cannot be crossed until the bridge is in.

(6) When additional bridging material is unavailable, the effect on the operation if the bridge were destroyed by the enemy.

(7) Availability and use of smoke-generating equipment."[15]

"Rafts are an excellent means of putting the high-priority essential vehicles into the bridgehead during the interval between the assault crossing and the completion of bridges. Employing men and equipment on raft construction and use, however, may retard the building of bridges. It takes almost as long to build a raft and to put it into operation as it does to build a bridge to span a stream which is 150 feet or less in width."[16]

"Bridges are constructed after the second objective (a position that eliminates the enemy's observed fires) is taken or earlier if enemy artillery fire proves to be ineffective, has been rendered so, or has been neutralized."[17]

Manuals up into the 1970s continued to reflect this more aggressive use of bridges, to include the 1972 version of FM 31-60 that I used with the 1st Armored Division. It included the following information:

"Failure to construct bridges early in the operation may result in delaying

Tanks of the 1st Brigade continue to pour across the Imjin to exploit success.

the advance beyond the river. This may allow the enemy time to reinforce with sufficient strength to delay or prevent securing the bridgehead."[18]

"The initial advantage of speed in commencing operation of rafts may be more than offset by the greater efficiency of bridges that can be placed in operation in a short time. Construction of bridges begins as early as possible."[19]

"If sufficient MAB equipment is available, consideration must be given to employing it as a bridge early in the operation. Assembly times are shorter when compared to other types of float bridges. In addition, if enemy fires should increase to a level endangering the bridge, the MAB units can rapidly disengage from one another and be reconfigured as rafts until the fires subside.[20]

I find it interesting that the older manuals address constructing bridges as soon as possible and go into more detail than our current manual does on considerations for omitting rafting. Going immediately to bridging should not be ruled out just because it is only addressed by four sentences in our doctrine. We need to emphasize the importance of rapidly building combat power and consider going straight to bridges. Immediate bridging operations should be a serious course of action for all river-crossing operations. The experiences gained during World War II, the Korean War, and the Cold War should not be forgotten by current doctrine. They must be overtly reflected in our current doctrine for planning considerations. We cannot raise a new generation of sapper warriors who don't seriously consider all options. This is especially important since American large-scale river-crossing experience is rapidly shrinking. With only a handful of active duty bridge units, we have largely lost our "hands-on experience." This makes doctrine even more important. Future generations of engineers will depend on it.

Summary

In the narrow scheme of things concerning river-crossing doctrine, we need to capture our experiences and include the considerations for going straight to bridging. We must make it a possible course of action and check the calculus to see if the benefits are worth the risk for the maneuver commander. Don't just ignore this option due to a doctrinal deficiency. As a doctrine-based organization, we must update our doctrine as our systems change, to provide more flexibility. Decision makers need to be empowered and not shackled with a doctrine that no longer fits the bill. Let's start the dialogue to help the Engineer School update our doctrine.

Who . . . and when? Us . . . and NOW!

Colonel Littlefield (now retired) was assigned to the U.S. Army War College's Department of Military Strategy, Planning, and Operations when he wrote this article. He previously commanded the 2d Infantry Division's Engineer Brigade. A graduate of the United States Military Academy, COL Littlefield holds a master's degree in operations research/systems analysis from the Naval Postgraduate School. He was a joint specialty officer and is a registered professional engineer in the state of Virginia.

Endnotes

[1] FM 3-93 (100-7), *Decisive Force: The Army in Theater Operations*, First Draft, July 2000, pp. 1-14.

[2] Sean D. Naylor, "Rock Bottom," *Army Times*, 11 September 2000, p. 8.

[3] Sean D. Naylor, "Training Command the Hardest Hit in Manning Plan", *Army Times*, 4 September 2000, p. 10.

[4] FM 90-13, *River-Crossing Operations*, 26 January 1998, p. 5-8.

[5] Ibid, pp. 7-14.

[6] Ibid, pp. 7-13.

[7] Ibid, pp. 3-11.

[8] Ibid, pp. 5-6.

[9] Ibid, pp. 5-8.

[10] Ibid, pp. 7-9.

[11] Ibid, pp. 1-6.

[12] FM 31-60, *River-Crossing Operations*, 27 March 1972, p. 60.

[13] Ibid, p. 67.

[14] FM 31-60, *River-Crossing Operations*, August 1952, para. 45.

[15] Ibid, para 45.

[16] Ibid, para. 62.

[17] Ibid, para. 63.

[18] FM 31-60, *River-Crossing Operations*, 27 March 1972, pp. 3-19.

[19] Ibid, pp. 3-28.

[20] Ibid, pp. 3-28.

Rapid Airfield Upgrade at Castle Assault Landing Zone

By First Lieutenant Nicholas Melin

22 August 2003

The president orders the XXVIII Airborne Corps and 82d Airborne Division to conduct a noncombatant evacuation operation in one country, while simultaneously providing support to an ongoing United Nations stability operation. The 82d notifies the 307th Engineer Battalion and its attached light equipment company, the 618th Engineer Company, during the mission analysis portion of the military decision-making process. The division operations officer and the division engineer estimate that at least eight airfields are required to successfully deploy the division's follow-on forces in theater, with one Interim Brigade Combat Team to arrive within 96 hours. Further analysis shows that the host nation has only four operational airfields in the area of operation and the Army must construct the rest. To meet the deployment timetable and handle the increased throughput of supplies, these airfields must be operational in 10 days.

Joint Rapid Airfield Construction Program

Unfortunately, it typically takes more than 30 days to complete an airfield construction project of this nature. Herein lies the issue confronting the Joint Rapid Airfield Construction (JRAC) program and the reason the 618th Engineer Company deployed to Fort Pickett, Virginia, from August to September 2001.

To meet the Chief of Staff of the Army's vision of deploying a combat-capable (medium) brigade anywhere in the world in 96 hours, a division in 120 hours, and five divisions in theater in 30 days, the U.S. Army Corps of Engineers, along with its Air Force counterparts, formed the JRAC program to look into the rapid construction and upgrade of airfields.[1] The three primary objectives of the program are to optimize airfield site selection, enhance airfield construction productivity, and incorporate advances in rapid soil stabilization.[2] Since the C-17 Globemaster III aircraft was designed to carry oversize loads (such as the M1A1 Abrams tank) and land on forward, semiprepared (such as dirt) airfields, the team is specifically interested in constructing and upgrading C-17-capable airfields.[3] As the only light equipment airborne engineer company in the Army, the 618th received the mission to upgrade Castle (formerly Wonju) assault landing zone (ALZ) at Fort Pickett from C-130 to C-17 specifications. Since there is such a limited number of C-17-capable, nonstabilized ALZs in the world, the company faced a considerable challenge. The 618th tested the feasibility of new, rapid airfield construction technology to be used in future construction operations. The lessons learned from this project may be useful to other construction units in the Corps of Engineers.

A soldier supervises operations on the field landing strip.

Computer-Aided Earthmoving System

Throughout the project, the 618th used a Computer-Aided Earthmoving System (CAES) marketed by Caterpillar®. Developed originally for the mining industry, it has been available commercially since June 1997.[4] CAES integrates site-planning and -design operations with construction to reduce costs and increase job-site efficiency. The system consists of onboard computers, Global Positioning System (GPS) receivers, data radios, a GPS reference station, and a radio network. The project designer and surveyors enter the design schematics into the command computer and map the design elevations for the site. Then they use a portable GPS to chart existing elevations. A comparison of the elevations reveals the cut and fill requirements for the project site.

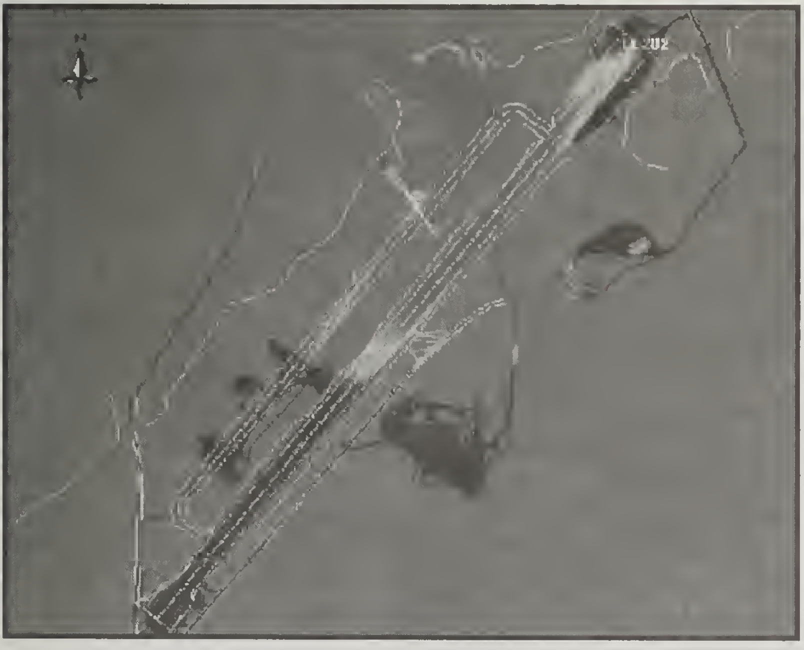
Although not the case during the deployment of the 618th, each piece of engineer equipment on the site should have a GPS and a computer terminal that transmits real-time updates of the site elevations. This allows project managers to track equipment activity and productivity daily. The GPS terminal mounted on the equipment shows the operator the site boundaries and the cut or fill required at any position. These features greatly decrease the requirements placed on surveyors during airfield construction. Normally, surveyors must stake out project boundaries and earthmoving requirements for the entire project. Using the CAES, equipment operators know their position on the site at all times and can move and shape earth to meet project requirements.

For the Castle ALZ project, engineers from Caterpillar installed the CAES terminals on two 613B scrapers and two deployable universal combat earthmovers (DEUCEs). Along with the radio network and reference station, the total cost of this system with training and installation would normally be $350,000. The JRAC program, along with Caterpillar, used the Castle deployment to examine the applications of the GPS in rapidly upgrading an ALZ.

Soldiers from 1st Platoon use a hand tamper to compact soil on top of dual 18-inch plastic corrugated culverts.

Planning and Preparation

Before the deployment to Fort Pickett, the 618th surveyors were already developing the airfield design. First, they conducted a topographic survey to map the existing ALZ. Surveyors also took soil samples from the ALZ and the two borrow sites and sent them to be tested at the U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, Mississippi. These tests identified the properties of the soil and its suitability for airfield construction. These tests must be conducted as early as possible since the quality of the soil is a primary factor in determining the earthwork required for the project. The results of the soil tests also established the optimum moisture content and the maximum dry density required to satisfy compaction criteria established by Engineer Technical Letter (ETL) 97-9. Another advantage of relying on ERDC to conduct the soil analyses was that ERDC could archive the data for future use, as well as coordinate for possible soil analysis training with the unit's surveyors and design team.



On this CAES image of Castle ALZ, the bumper number of one of the CAES-equipped DEUCEs, LE202, is shown at the north end of the runway.

After determining the dimensions and elevations, the surveyors designed the ALZ. Using information in ETL 98-5, they determined the requirements for a maximum aircraft on ground (MOG) 2, C-17-capable ALZ (see table, page 26). The major changes required were to add turnarounds at each end of the runway, move the taxiway to allow for C-17 wingtip clearance, and increase compaction. The surveyors then entered the design into the Terramodel™ software. This design program allowed the head surveyor and ALZ designer to download the elevations gathered during the survey and make the necessary alterations to the existing ALZ. The finished design provided the required elevations at each point along the runway and taxiway.

Integrating the CAES into the 618th required training for both operators and surveyors. The surveyors spent a week working with

Critical Dimensions for a C-17 ALZ[5]

Runway:

- Length – minimum 3,500 feet
- Overruns – 300 feet on each end of the runway to the same standards
- Turnarounds – 165 feet wide by 180 feet long (may be included in overruns)
- Width – 90 feet
- Shoulder width – 10 feet
- Width of graded area – 35 feet on each side of runway beyond shoulders
- Width of transitional area – 70 feet on each side beyond graded area
- Longitudinal runway grade change – 1.5% maximum per 200 feet
- Transverse grade of runway shoulders – 1.5% minimum, 5% maximum

Taxiway:

- Length – 3,500 feet with turnarounds or the entire length of the runway
- Turning radii – 90 feet
- Shoulder width – 10 feet
- Longitudinal grade – 3%, with a maximum change of 2% per 100 feet
- Runway clearance – 280 feet from centerline of runway to inside shoulder of taxiway
- Taxiway clear area width – 70 feet
- Infield area – must be clear of obstructions

representatives from Caterpillar to learn the setup and maintenance of the CAES. Then, the 618th conducted a field-training exercise where surveyors set up the GPS equipment and instructed equipment operators on using the computer displays in the equipment. With operators and surveyors well-trained, the company was ready to deploy to Fort Pickett and build an airfield.

Main Effort: The Runway

To upgrade the ALZ to C-17 specifications, the 618th made numerous alterations to the existing C-130 ALZ. The main effort, which was assigned to 2d Platoon, was to upgrade the 4,100-foot runway. This included reshaping and compacting it and adding 165- by 180-foot turnarounds at both ends. But before this work began, it was necessary to repair the existing C-130 ALZ.

The runway was overgrown with grass and had at least 6 inches of organic material that needed to be grubbed. Additionally, to expand the clear and transitional areas on either side of the runway to meet C-17 requirements meant clearing and grubbing a considerable area, to include trees. The CAES was useful for this task. The equipment operators did not have to wait for surveyors to stake in the boundaries of the runway. Using the display terminal, operators followed the design boundaries and marked the area that needed clearing.

After they completed the clearing and grubbing, the 618th established borrow and waste pits from which fill material could be moved to the runway and waste material stockpiled. Then, to reach the design grade, 2d Platoon cut and filled the runway. (Many places required fill in excess of 2 feet.) Since the CAES has a horizontal accuracy of plus or minus 3 inches associated with earthmoving, it was possible to complete a large portion of the cut without grade stakes. However, to get the runway to standard, it was then necessary to shape and compact it to meet density and moisture requirements and allow for proper drainage. Because of the error margin associated with the CAES, it was not useful for the precision grading required to ensure that the runway met slope requirements.

As 2d Platoon moved down the runway, the surveyors verified that the completed work met compaction requirements. Using a nuclear densometer, they measured the density and moisture, and with a dynamic cone penetrometer, they confirmed California bearing ratio requirements. Where these measurements failed to meet the required standard, the soil had to be scarified (disked) and recompacted.

The final step was to grade the runway to ensure that it had a proper crown and drainage. Although the CAES was not useful during this phase of construction, the system's advantages allowed 2d Platoon to finish its portion of the project a week ahead of schedule.

Supporting Effort: The Taxiway

Perhaps the most difficult assignment went to 1st Platoon to move the taxiway 40 feet to the west to allow wingtip clearance for the C-17 aircraft. This required installation of three 18-inch double culverts and a large amount of earthwork on the shoulders and clear area.

The CAES dramatically reduced the amount of time it took to locate the culverts. Instead of having to stake and restake them to ensure that they were straight and at the proper slope, the platoon used the CAES with the culvert design loaded into the system. The display terminal in the cab of the DEUCE showed the operator how much to cut within 3 inches. The surveyors then placed grade stakes and string lines to achieve the final grade and desired slope. By using the CAES, the experienced crew saved one day of work on each culvert.

Another timesaving measure was that the platoon used corrugated plastic culverts rather than the standard concrete or corrugated metal pipes. They were light enough so that two people could carry a 20-foot section and could also easily attach multiple sections using connectable lips. A drawback of plastic culverts was that the slope had to be carefully checked because the plastic had a tendency to bend and distort.

Clearing and grubbing the taxiway occurred concurrently with culvert installation. By using nonorganic D7 bulldozers

Surveyors determine the earthwork required for the project.

and 621B scrapers, it was fairly easy to clear the necessary area to move the taxiway. The fill requirements, however, were significant.

The natural slope of the areas around the taxiway required lifts of more than 5 feet in some areas. Moving enough earth to reach grade effectively eliminated any gains made from the quick installation of the culverts. After completing the earthmoving, the platoon established drainage into and out of the culverts by shaping the infield (the area between the runway and taxiway) and the shoulders of the taxiway. The taxiway was shaped and compacted in the same manner as the runway. The CAES made it possible to finish construction five days ahead of schedule.

Supporting Effort: The Tank Test Track and Road Extension

The 3d Platoon was detached from the ALZ project to construct a 1.5-mile-long tank test track, a 0.25-mile emergency road extension, and a helipad for Fort Pickett. Although not involved with the ALZ construction, these projects were considered by the installation's chain of command as the main effort for the deployment.

The site chosen for the test track was next to Blackstone Army Airfield. When constructing the airfield, the location of the tank test track was used as the waste pit for the project. All the organic materials were heaped in this area. When 3d Platoon started working on the test track, it was overgrown and looked like a patch of woodland.

Not until the platoon cleared and grubbed the track did it become apparent that there would be a problem with the amount of organic material in the soil. In addition, the soil had insufficient strength to meet the requirements of the road. It was of such poor quality that it had to be cut out to a depth of 3 feet and replaced with clay from the borrow site at the ALZ. This necessitated hauling 2,000 cubic yards of soil over a 12-mile route. Once the dirt was hauled in, the platoon was able to compact the subgrade for the road and begin hauling the 3,500 cubic yards of gravel needed for the surface of the track.

The emergency road extension also provided some unexpected challenges. To obtain proper drainage for the road, five 20-foot-long culverts were added to the test track and road extension. With no CAES assets on site, and a constantly evolving design concept, the platoon had to construct the road using the tedious staking method. This operation took 5 days and verified the advantage of using GPS technology with culvert emplacement.

Lessons Learned

The Castle ALZ construction project demonstrated both advantages and shortcomings of the CAES for use in rapid airfield construction:

Advantages

- As an enhanced surveying tool, the system worked well. It allowed operators and supervisors to "see" project boundaries, even during hours of limited visibility, and accurately map them using engineer equipment. It cut down on the direct surveyor support required at the beginning of the project, thereby allowing the engineer unit to mass them at the main effort.
- The system was very useful when conducting shift-change briefs. The outgoing construction foreman could easily show the construction officer and incoming construction foreman the progress made during the day. Similarly, the construction officer could easily delineate the scope of work for the incoming construction foreman and equipment operators. It was also helpful in giving an overview of the status of the project.
- The system was easy for operators to use, and it was not difficult to establish command and control from a centralized location. However, line of sight was required.
- The system was a valuable asset when placing culverts. It allowed for accurate excavation without use of grade stakes until nearing the final excavated grade.

A scraper performs cut and fill operations.

- The system was valuable for large cuts and fills in earthmoving operations. If in excess of 1 foot, the CAES allowed operators to move earth without grade stakes. And the display in the cab provided a visual indication of progress.
- Tracking the equipment across the entire job site made it possible to determine the overall progress of the project (volume of earthwork moved). However, since the system was only installed on four pieces of engineer equipment, it was difficult to evaluate the utility of the CAES in tracking individual equipment productivity.

Shortcomings

- The utility of the system is only as good as the inputted design. In one case, the design placement of a culvert was incorrect. The error was not discovered until after the culvert was partially installed, which required additional labor to correct. Although this was a man-made error and not a product design, it reinforced the importance of quality control on a job site. It should also be noted that the CAES allowed the 618th to rapidly correct the deficiency.
- The system was not useful in the final grading of the runway or taxiway. The error margin in the system was too great for the precision work required to successfully complete the project.
- It would be difficult—if not impossible—to use this technology (as currently designed and implemented) during initial-entry operations in an immature theater of operations. However, it could be a valuable asset in a scenario where the initial airfield was capable of receiving air-land personnel and equipment, the lodgment had been secured, or the airhead had been expanded and had the infrastructure to support the use of laptop computers (from a tactical operations center or similar location). Automation support is about the only external requirement to make this system operational since the GPS reference station and radio receivers/transmitters are solar-powered, while the equipment-mounted systems are battery-powered.

Conclusion

Using the CAES in the Castle ALZ upgrade provided a glimpse into the future of airfield construction. The use of GPS technology to increase information available to operators had a definite effect on construction efficiency. Despite the fact that the 618th used only four mounted systems, the overall construction time on the ALZ decreased by five to seven days when compared to the forecasted duration of the project. Moreover, it was so essential in the construction process that maintenance and repair of vehicles with CAES equipment became a top priority. Although the technology itself does not solve all the challenges of JRAC, the CAES certainly decreases the time necessary to upgrade an ALZ. As shown during the project, the effect of terrain and weather on construction time is significant. The use of GPS for site selection could improve these areas. Soil stabilization of the dirt in ALZs will also decrease airfield maintenance throughout the duration of operations. In the future, the Castle ALZ at Fort Pickett could become a useful test location for JRAC.

First Lieutenant Melin is working on a master's degree in civil engineering at Oxford University in England. He previously led 2d Platoon, 618th Engineer Company (Light Equipment) (Airborne), in support of the 325th Airborne Infantry Regiment. 1LT Melin is a graduate of the United States Military Academy and holds a bachelor's degree in civil engineering.

Endnotes

[1] Jeb S. Tingle, E.I., Research Civil Engineer, U.S. Army Corps of Engineers, Engineer Research and Development (ERDC), Geotechnical and Structures Laboratory, Vicksburg, Mississippi.

[2] FM 100-17-3, *Reception, Staging, Onward Movement, and Integration*, 17 March 1999.

[3] Travis A. Mann, *Joint Rapid Airfield Construction (JRAC) Enhanced Earthmoving Capability (EEC) Technology Demonstration*, ERDC Trip Report, 4 May 2001.

[4] Caterpillar Promotional Pamphlet, *CAT Computer-Aided Earthmoving System*, 2000.

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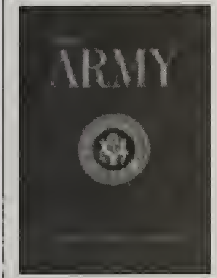
Book Reviews

The Army, Brigadier General Harold W. Nelson, Editor in Chief. The Army Historical Foundation/Hugh Lauter Levin Associates, Inc; Arlington, Virginia, 2001, 352 pages, 600 illustrations.



The Army is a richly illustrated historical overview of the United States Army prepared by the Army Historical Foundation. Its authors are largely retired senior military officers, many with a background in published military history. The volume covers such topics as the role of the Army in nation-building, the history of the Medal of Honor and other military decorations, the Army Schools, and the role of the Reserve Components in the wars of the nation. As such, *The Army*, is not an illustrated history of the Army, but a historical overview of some aspects of the Army and its more than 200 years of service to the United States.

The volume has an introductory article by serving Army Chief of Staff, General Eric K. Shinseki, and a concluding article by Lieutenant Colonel Clayton R. Newell, U.S. Army, Retired. The former article deals with the Army Vision and its association with both the Army of yesterday and the Army of the future. The latter article documents some of the emerging technology that the Army is seeking to bring to the battlefield. These bookend articles place the historical material into the context of the Army today and the future of the service in the years ahead.

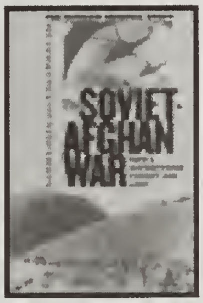
One of the outstanding features of *The Army* is the inclusion of 600 photographs, reproductions of military art, and other illustrations. The art is by such established military artists as Mort Kunstler, Don Troiani, Don Stivers, and Dale Gallon. The artwork by these and other artists adds a colorful and dramatic aspect to the more common black and white photographs of the nineteenth and twentieth century Army that many readers are familiar with. The reproductions of this military art are almost worth the price of the book alone.

Although *The Army* is written by those with the requisite historical training to produce an authoritative work, the book does suffer from an occasional error in accuracy. However, the errors in the text do not detract from the visual value of the volume and the overall story the authors and editors convey. *The Army* would make an excellent addition to the bookshelves of the general reader or history buff. Those wanting more depth to the areas covered in this volume can start with the professional reading materials noted in the *Suggested Reading* portion.

Dr. Larry D. Roberts is the U.S. Army Engineer School historian at Fort Leonard Wood, Missouri.

Note From the Publisher: Purchasing *The Army* not only will be of interest to readers but also will directly benefit the Army Historical Foundation, which receives a royalty on each book sold. The Foundation is a nonprofit organization dedicated to the preservation and promotion of Army history and traditions. It directly supports the historical programs of the Army and is an integral part in the building of a national Army museum.

The Army can be ordered directly from the Army Historical Foundation (703-522-7901 or *http://www.armyhistoryfnd.org/*). It is also available through warehouse clubs, local bookstores, and online. Visit the Foundation's Web site for more information *(http://www.hlla.com).*



The Soviet-Afghan War: How a Superpower Fought and Lost by Russian General Staff (Editor), Lester W. Grau (Translator), Michael A. Gress (Translator). Foreword by Theodore C. Mataxis.

The War in Afghanistan (1979-1989) has been called "the Soviet Union's Vietnam War," a conflict that pitted Soviet regulars against a relentless, elusive, and ultimately unbeatable Afghan guerrilla force (the mujahideen). The hit-and-run bloodletting across the war's decade tallied more than 25,000 dead Soviet soldiers, plus a great many more casualties, and further demoralized a USSR on the verge of disintegration.

In *The Soviet-Afghan War,* the Russian general staff takes a close critical look at the Soviet military's disappointing performance in that war in an effort to better understand what happened and why and what lessons should be taken from it. Lester Grau and Michael Gress's expert English translation of the general staff's study offers the very first publication in any language of this important and illuminating work.

Surprisingly, this was a study the general staff never intended to write, initially viewing the war in Afghanistan as a dismal aberration in Russian military history. The history of the 1990s has, of course, completely demolished that belief, as evidenced by the Russian army's subsequent engagements with guerrilla forces in Chechnya, Azerbaijan, Tadjikistan, Turkmenistan, and elsewhere. As a result, Russian officers decided to take a much closer look at the Red army's experiences in the Afghan War.

The study presents the Russian view of how the war started, how it progressed, and how it ended; shows how a modern mechanized army organized and conducted a counterguerrilla war; chronicles the major battles and operations; and provides valuable insights into Soviet tactics, strategy, doctrine, and organization across a wide array of military branches. The editors' incisive preface and commentary help contextualize the Russian view and alert the reader to blind spots in the general staff's thinking about the war.

This one-of-a-kind document provides a powerful case study on how yet another modern mechanized army imprudently relied upon the false promise of technology to defeat a determined guerrilla foe. The Red army had fought its war to a military draw, but that was not enough to stave off political defeat at home.

This book is part of the *Modern War Studies* series.

About the Translator/Editors:

Lester W. Grau, a Vietnam War veteran and retired U.S. Army lieutenant colonel, is an analyst for the Foreign Military Studies Office at the Army's Combined Arms Center at Fort Leavenworth, Kansas. He is also the editor and translator of *The Bear Went Over the Mountain: Soviet Combat Tactics in Afghanistan* and *The Other Side of the Mountain: Mujahideen Tactics in the Soviet-Afghan War.*

Michael A. Gress is a native of Siberia and a former soldier in the motorized rifle forces of the Soviet army.

Partnership Training

By Captain Daniel J. Meyers

The U.S. Army's 1st Infantry Division Engineer Brigade, Headquarters and Headquarters Company (HHC), and Germany's *Stabskompanie, Pionierlehrbrigade 60*, have a unique partnership. Our focus is on building trust, camaraderie, and mutual respect at all levels—from the newest private to the brigade commander. Through a variety of activities, ranging from combined-arms training to social events, we achieve a greater understanding of each other's capabilities—an understanding that is beneficial and rewarding to both the soldiers and the organizations. Combining training opportunities causes an increase in *esprit de corps* and interoperability. The events over the past decade in Europe confirm a strong need to understand each other's armies as we perform operations as multinational forces. Our partnership training has directly improved our readiness posture.

For three consecutive years, Engineer Brigade's HHC has earned the title "Best Continuing Partnership" within the 1st Infantry Division. The competition is fierce, but quality and quantity of training make all the difference. The result of cohesive activities is displayed through awards, language skills and, most important of all, a better understanding of customs and traditions of the two countries.

A soldier fires the MG-1.

One of the primary points of emphasis in the partnership is the training and development of junior enlisted soldiers in both units. Our planning continually strives to provide them with opportunities to learn. We believe that training as partners strengthens the soldiers' desire to stay in the service and enhances their careers.

Both German *Unteroffiziers* and American NCOs are provided the unique challenge of instructing soldiers from a foreign army. The language barrier is just one hurdle that must be negotiated. Other difficulties include cultural differences and a lack of familiarity with foreign weapon systems.

A combined crossing of a water hazard

Exchanging marksmanship techniques is one ingredient toward a successful partnership because it enhances interoperability. To earn the coveted *Schuetzenshnur*—in either bronze, silver, or gold—is a goal of each soldier. The German weapons qualification consists of three weapons, and soldiers must qualify on all three to earn the *Schuetzenshnur*. Firing the pistol (P1) is an easy task, but the other two weapons—the G3 (equivalent to the M16) and MG-1 machine gun—are tougher because their high caliber causes a powerful kick.

Another area of concentration with our partnership unit is physical fitness. For U.S. soldiers, the goal is to "max" the Army Physical Fitness Test. While all do their best, not everyone can qualify for the badge. The same holds true for the *Leistungsabzeichen* (German sports badge). Passing both tests is an indicator of excellent physical fitness.

This year, not only did we train on both German and American weapons, but we also survived the rigors of a white-water river exercise, marched over several mountain peaks, and competed in a variety of sporting events. The NCOs and officers, up to and including the brigade commanders and command sergeants major, led their soldiers with skill and decisiveness. They planned and executed training, met for equipment demonstrations, and led their soldiers in the celebrations that marked another successful year.

For the past two years, our units have hosted an event called "Project Teamwork." The concept is to provide soldiers of both nationalities an opportunity to train, challenge, and compete against other teams, using cooperation and collaboration. Comprised of both German and American soldiers, the teams are presented with a series of obstacles or tasks, such as weapons assembly/disassembly; first aid procedures; nuclear, biological, and chemical agents; a grenade toss; and a water hazard. Each scenario forces the soldiers to think as a unit and conquer the obstacle or complete the task through teamwork. These events foster the foundation of our partnership. They are the mechanisms that support our title "Best Continuing Partnership" in the division.

Ceremonies provide a good avenue to share traditions and customs. The *Gelobnis* (graduation) ceremony is a good example. We are invited to attend the ceremony whereby German soldiers are officially indoctrinated into the *Bundeswehr*, and our partnership unit is invited to our change-of-command ceremonies.

In addition to the soldier tasks of weapons familiarization, physical fitness evaluation, and ceremonial activities, we share experiences, leadership development, award recognition, and cultural enlightenment. The friendships that ensue are a byproduct of the continuous training opportunities.

During the holiday season, we participate in each other's festivities. The somber gatherings have given way to more upbeat parties. Perhaps the best example is the white elephant gift exchange. Our partnership unit finds this to be a very intriguing event. So this past holiday season, each German soldier brought a gift so that he could participate.

The 1st Infantry Division Engineer Brigade's HHC has a common bond with *Stabskompanie, Pionierlehrbrigade 60*, and we look forward to broadening our partnership in the future. Statistics prove that we have a powerful foundation. Solidarity is our core asset and will continue to provide stability and strength for years to come.

Captain Meyers is the battalion maintenance officer, 1st Infantry Division Engineer Brigade, HHC, and also serves as the brigade S3. He holds a bachelor's degree in urban planning from the University of New York at Albany. His next duty assignment is the Captain's Career Course at Fort Leonard Wood, Missouri.

The Engineer Writer's Guide

Engineer is a professional-development bulletin designed to provide a forum for exchanging information and ideas within the Army engineer community. We include articles by and about officers, enlisted soldiers, warrant officers, Department of the Army civilian employees, and others. Writers may discuss training, current operations and exercises, doctrine, equipment, history, personal viewpoints, or other areas of general interest to engineers. Articles may share good ideas and lessons learned or explore better ways of doing things.

Articles should be concise, straightforward, and in the active voice. If they contain attributable information or quotations not referenced in the text, provide appropriate endnotes. Text length should not exceed 2,000 words (about eight double-spaced pages). Shorter after-action-type articles, reviews of books on engineer topics, and letters to the editor are also welcome.

Include photos (with captions) and/or line diagrams that illustrate information in the article. Please do not include illustrations or photos in the text; instead, send each of them as a separate file. Do not embed photos in PowerPoint. If illustrations are in PowerPoint, avoid excessive use of color and shading. Save digital images at a resolution no lower than 200 dpi. Images copied from a Web site must be accompanied by copyright permission.

Provide a short paragraph that summarizes the content of the article. Also include a short biography, including your full name, rank, current unit, and job title; a list of your past assignments, experience, and education; your mailing address; and a fax number and commercial daytime telephone number.

Include a statement with your article that your local security office has determined that the information contained in the article is unclassified, nonsensitive, and releasable to the public. We do not require a hard copy of the clearance. (*Engineer* is available for sale through the Superintendent of Documents.)

We cannot guarantee that we will publish all submitted articles. They are accepted for publication only after thorough review. If we plan to use your article in an upcoming issue, we will notify you. Therefore, it is important to keep us informed of changes in your e-mail address or telephone number. All articles accepted for publication are subject to grammatical and structural changes as well as editing for style.

Send submissions by e-mail to pbd@wood.army.mil or send a 3 1/2-inch disk in Microsoft Word, along with a double-spaced copy of the manuscript, to: Editor, *Engineer Professional Bulletin*, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

Note: Please indicate if your manuscript is being considered for publication elsewhere. Due to the limited space per issue, we normally do not print articles that have been accepted for publication by other Army professional bulletins.

THE EURO NATO TRAINING ENGINEER CENTRE:

YOUR INTERNATIONAL ENGINEER SCHOOL

By Major Frank Akins and Sergeant First Class Benjamin Addison

Since 1977, the Euro NATO Training Engineer Centre (ENTEC) in Munich, Germany, has provided engineer interoperability training to increase efficiency between military engineers of NATO and its partner nations during peacetime and war. The current focus is primarily engineering interoperability challenges within peace support operations from squad to division level.

ENTEC is organized into four cells (see figure), which are powered by 14 primary instructors, ranging from sergeants first class to lieutenant colonels:

- Tactics and Doctrine Branch—provides instruction pertaining to tactics and doctrine, including input for development of Standardization Agreements (STANAGs).
- Mine/Countermine and Demolitions Branch—focuses on training related to mine/countermine equipment, mine and booby trap threat, and demolition equipment used and encountered by ENTEC member nations.
- General Engineering Branch—concentrates on military bridging, combat engineer and construction equipment, reconnaissance, and base camp construction.
- Military Engineer Consultancy—collects and catalogs current engineer lessons learned and provides them, upon request, to NATO nations. This cell is also an excellent source of information concerning national engineer force structures and organizations.

Levels of Instruction

ENTEC conducts four levels of course instruction per year: Instructor's Course, Platoon Leader's Course, Company Commander's Course, and Battalion Commander's Course. ENTEC also provides mobile training teams to units upon request.

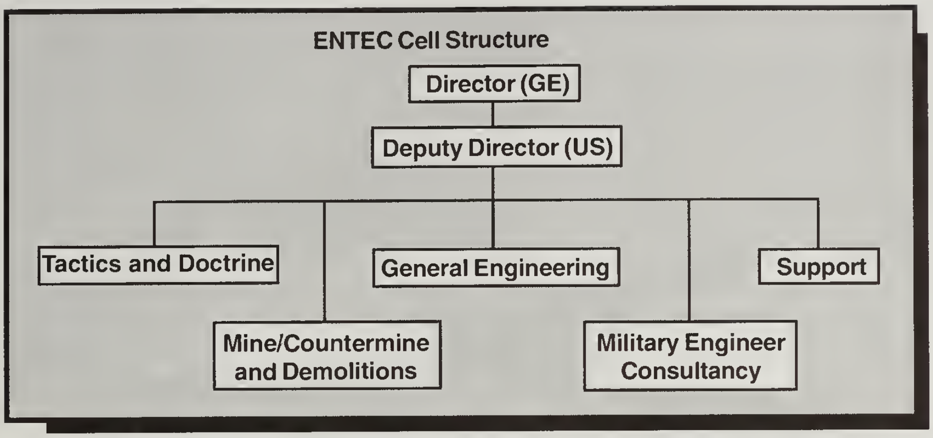
Instructor's Course

This 2-week course is designed to promote and improve engineer interoperability at squad leader through platoon leader levels. It is the "bread-and-butter" course, encompassing a maximum amount of hands-on training with classroom instruction. When engineers complete this course, they can teach soldiers mine awareness, international explosives use, demolition target folder preparation, demolition mission handover/takeover, barrier control and execution, international engineer lessons learned, and how to obtain international military engineer assistance on a moment's notice.

Platoon Leader's Course

This week-long course promotes and improves engineer interoperability at platoon and company levels by introducing officers and noncommissioned officers to engineer operational

Hands-on booby trap training facility



ENTEC Cell Structure

and tactical interoperability challenges and how to overcome them. Through a combination of classroom and team instruction, map exercises, and hands-on training, students gain an understanding of the characteristics and capabilities of each ENTEC nation in demolition, bridging, combat engineering, and construction equipment. Students become familiar with mine/countermine equipment employed across NATO and gain an understanding of correct policy and procedures for training on and employment of antitank and antipersonnel mines. This course is more tactically oriented and less technically focused than the Instructor's Course.

Company Commander's Course

This course promotes and improves interoperability at company to battalion levels by introducing officers to the engineer operational and tactical procedures of all participating nations. Instructors provide orientation to several force-projection missions and discuss international lessons learned. Guest speakers from several ENTEC nations discuss experiences in combat and peacekeeping operations. The focal point of this course is an in-depth map exercise that facilitates planning for a multinational, out-of-sector mission, encouraging officers to solve complex problems in an international working-group environment. Students are introduced to common interoperability challenges and how to overcome them. They receive a brief orientation on demolitions, bridging, combat engineer, and construction equipment from each ENTEC nation and the important characteristics and capabilities of each. Various social functions during the course encourage students to interact with their multinational colleagues.

Battalion Commander's Course

This course promotes and improves engineer interoperability at battalion and brigade levels by introducing officers to the engineer operational and tactical procedures of all participating nations. Guest speakers discuss recent experiences in combat and peace-support operations and provide lessons learned. An in-depth map exercise on out-of-area contingency operations is the main vehicle of learning. The ENTEC staff introduces officers to common interoperability problems and how to overcome them. A guided tour of Munich, museum visits, and a semiformal dinner increase interaction among officers from the various nations. There is also a VIP Day during the course that provides an opportunity to meet with many national engineer school officials and see some of the latest engineer equipment available on the worldwide market.

Training Aids

A series of training aids increases multinational interoperability effectiveness: a 10-language Combat Engineer Dictionary CD, bilingual handbooks, a one-stop source for international engineer lessons learned, an Engineer Platoon Leader's Handbook, and more. Instructors participate in NATO standardization working groups pertaining to combat engineering interoperability issues, as well as other activities to promote engineering interoperability.

Other Activities

The ENTEC staff supports NATO exercises around Europe. And ENTEC is the perfect off-site location for exercises and conferences. On request, ENTEC supports individual units or headquarters with mobile training teams, which are usually scheduled and approved a year in advance but can react to short-notice requests in crisis situations. ENTEC's Web site at *http://www.entecmunich.de* provides more information.

Conclusion

ENTEC offers a unique opportunity to learn about international engineer interoperability and to make contacts and friends in the international community. All TDY and course fees are reimbursed for U.S. soldiers stationed in Europe. Course tuition fees are covered for U.S. soldiers stationed within the United States. The ENTEC staff members invite you to visit the training center and join them in future classes and activities.

Contact MAJ Akins at *frank.akins@catc.7atc.army.mil* or call 011-49-89-95959482.

Major Akins is the deputy director of the Euro NATO Training Engineer Centre. He is a graduate of the Command and General Staff Course and holds a master's degree in geology/civil engineering.

Sergeant First Class Addison is the senior U.S. instructor at the Euro NATO Training Engineer Centre. He has attended the Basic and Advanced Noncommissioned Officers Courses, Primary Leader Development Course, Air Assault and Airborne Courses, and the Sapper Leader's Course.

Photograph by PH1 William F. Gowdy

The Real Army

By Lieutenant Colonel Monte R. Anderson (Retired)

Everyone talks about the "Real Army," but no one knows where it is. *Not really*. I retired in 1990—after 22 years in the Infantry Corps—and I think I spent my entire career looking for the Real Army, that mythical Holy Grail of professionalism. I never did find the Real Army, but somewhere on my quest, I learned a thing or two about professionalism.

I started my career as a cadet at West Point. I was taught by some of the sharpest and brightest young captains of the military, many of them combat veterans of Vietnam. They were the cadre I looked up to and who set the example for me to follow. I was reminded on numerous occasions that when I graduated and pinned on that butter bar, I would join the ranks of the Real Army. Those veterans, who surely knew of such things, assured me, in no uncertain terms, that the Real Army would be more demanding and less forgiving of my ignorance and errors. My decisions would mean life or death for members of my platoon. It was, therefore, with some anticipation that I looked forward to joining the Real Army.

After graduation, I went through a series of military schools—airborne, jump master, ranger, and the Infantry Officers Basic Course—all designed to finely hone my skills and instill in me the fighting spirit that I would need in the Real Army. Much to my disappointment, I was informed that these schools were not the Real Army. For that, I would have to wait. I was told this by some of the best NCOs in the Army. The cadre at West Point had told me that such men existed, and here they were in the flesh. These were men with many years of experience in leading and training soldiers, real soldiers from the Real Army. Nearly all were combat veterans, and most certainly knew the difference between the Real Army and the school environment. I studied hard to prepare myself, but I was becoming impatient to find the Real Army. I longed to be in a unit where every soldier was highly motivated and each man knew his duty—a place where the title "soldier" meant being proud, standing tall, combat ready, lean and mean. That's what I wanted and, by God, I meant to have it.

All too soon my military schooling ended, and I joined the 82d Airborne Division. But that was not the Real Army, I was told by senior officers who must be privy to such knowledge. It was the late '60s. Drugs were a major problem, and we were coddling drug users and trying to rehabilitate them. Combat veterans who had only a few months left to serve were "short-timers" with bad attitudes. New recruits were green and hardly knew basic soldier skills. The division was understrength and short on equipment. Even with my inexperienced eyes, I could see that, indeed, this could not be the Real Army.

Soon I was a first lieutenant en route to the 101st Airmobile Division in Vietnam. I thought my search would soon be over. When I took over my new platoon, I discovered that it, too, was not the Real Army. It was a group of scared young men just trying to keep from getting killed. They looked to me not to lead them to victory but to keep them alive long enough to take that long flight back home. They did everything I asked them to do, but they were not eager to reenlist.

Morale was low and got even lower. The young men didn't hate the Vietcong or the North Vietnamese and actually hoped they would not see one. They lived in fear, drank whenever they could, and smoked a joint now and then when I wasn't around. But together we survived. We learned how to bring superior firepower to bear without exposing ourselves to enemy fire. We learned to conceal ourselves so well in an ambush that the enemy could not see us until it was too late. We learned not to bunch up on the trail, to move without any noise, and to keep our equipment operational. We looked out for each other. We all cried when one of us got a "Dear John" letter. We all cheered when one of us heard he was now a father. We celebrated when someone got his orders to go home. We shared our dreams and aspirations. My dream was to find the Real Army. We all made it back to the States.

I returned to the 82d Airborne for two more years. Then I went to the Armor Officers Advanced Course at Fort Knox, Kentucky; on to graduate school; and back to West Point as an instructor. I was now part of the elite cadre—and yet I had never seen the Real Army. I almost gave up my search. All the other instructors talked about it, but no one had actually seen it. One armor officer said that he almost saw it in Germany, but it apparently had departed before he got there and never returned. We pretty much agreed that it was either in Germany somewhere or maybe in Korea, but it certainly was not stateside. So Germany was the next stop on my quest. I would surely find the Real Army in Germany.

Germany was totally different than I had imagined. I was assigned to an infantry unit at Wildflecken. The Cold War was still going strong in the late '70s. My battalion had a wartime mission to be the covering force for the brigade. We expected high numbers of casualties. Wildflecken was within artillery range of the East German border, and we fully expected to be under fire from our billeting area all the way to our deployment positions. Our only hope would be early warning. We took our mission seriously. We trained in the field for weeks on end, once for 6 weeks straight. Every day in the field meant 3 days in the motor pool, maintaining our equipment. I thought, "If this isn't the Real Army, we are in trouble." But things were not as they should have been. We still had drugs. The equipment was old. I was positive that I had an M113 with Patton's initials on it. There were also personnel shortages. It was part of the "Hollow Army"— too many missions and not enough men and equipment. I began to suspect that this was not part of the Real Army.

My worst fears were confirmed. Senior NCOs who, of course, know of such things, told me that this was not the Real Army. Not any more! Some had spent many years in Germany. All had been to Vietnam and in stateside units. One NCO had been around the world three times and to a world's fair, two circuses, and a county fair. He knew everything, and he informed me that the Real Army no longer existed. It had died, unannounced, sometime between World War II and the Korean War. However, he had not actually been to Korea and, perhaps, a small remnant of the Real Army remained there. There was still hope.

The Army in Germany was in a metamorphosis. We concentrated on combating the drugs and made major headway. The Army moved to an all-volunteer Army, combined with frequent and random drug testing and easier ways to get rid of drug users. The new recruits arrived drug-free and with a positive attitude. They were well-trained in basic soldier skills. We began to develop teamwork and a sense of unit pride. We went from mastering platoon operations to company—and then to battalion and task force—tactics. Soon we became proficient at brigade and division maneuvers. It was as if we were beginning to create the Real Army ourselves.

I went from Germany to the Command and General Staff College at Fort Leavenworth, Kansas. After graduation, I stayed on as a tactics instructor for 3 years. It was not, of course, the Real Army. We invented an imaginary army that could do anything—attack, defend, envelop, withdraw, cross rivers, and perform airmobile operations and urban fighting. You name it, this army could do it. Of course, the students had to plan for this dream army. It was always at 100 percent strength, sometimes 110 percent. It had the latest equipment, some of which had not really been fielded. There was no end to the supplies and logistics, as long as it was planned for and coordinated. It was the perfect army—on paper. We were in the middle of developing the AirLand Battle doctrine and supporting tactics.

In 1984, I went from Fort Leavenworth to be the Inspector General of the 2d Infantry Division in Korea. It was my sincere hope to finally find the Real Army. I was in a position to do a proper search. I inspected every unit in the division and was impressed by what I found. The soldiers were highly motivated, well-trained, and well-led. While the Cold War was coming to a close in Europe, that was not the case in Korea. The 2d Division stood toe-to-toe with the North Korean army, and every soldier understood his mission clearly. The division was up to strength and well-equipped, with new equipment arriving every day. This was not the Army of the '60s or the '70s. Every soldier had volunteered to be there. Drug use was way down. I thought that at long last I had finally found the Real Army, but it was not to be. Nearly one-third of the division's soldiers were Korean Augmentees—excellent Korean soldiers who spoke English. Most had been drafted and given a choice of serving with the Korean or the U.S. Army. That made the 2d Division unique, because no other unit was made up of allied soldiers. No doubt, in the event of war with North Korea, these soldiers would be invaluable assets to the division. However, as configured, the 2d Division could not deploy to any other theater of operations. It was a stand-alone, one-of-a-kind unit. It was not the Real Army.

In 1985, I was reassigned to the Pentagon, and I despaired of ever finding the Real Army. There, we tried to forecast what the Real Army of the future should be, based on our own concept of what that might be. This was made more difficult by the ending of the Cold War, the collapse of the Soviet empire, and the growing threat in the Middle East. New equipment was

(continued on page 39)

Modernized Demolition Initiator Update

By Sergeant First Class Jeffrey Venus (Retired)

The Army is fielding the newest components to the Modernized Demolition Initiator (MDI) family—the M151 and M152 booster assemblies. These components are the materiel solutions for the restrictions placed on the MDI in 1998, which limited the operational uses of the M11 and M16 MDI shock tubes. The M11 and M16 will be phased out as they are replaced by the M151 and M152. The new MDI components will give our soldiers the most modern pieces of equipment in the demolition inventory and ensure that they have the competitive edge required on the battlefield.

Background

The MDI was initially fielded in 1996. But testing indicated, and field commanders confirmed, that there were serious shortcomings. The problems center on a simultaneity issue and the sensitivity of the high-strength blasting caps. In addition, field commanders raised issues concerning burying high-strength blasting caps and prepriming charges for transport to mission sites. Due to these shortcomings, on 3 December 1998, the Engineer School issued a Letter of Instruction that restricted the use of the M11 and M16 MDI components until these issues were resolved.

Description

The MDI is used for standard military demolition missions. When first type-classified in 1996, the MDI had a safety limitation that prohibited the priming of underground charges with devices containing sensitive primary explosives. The M151 and M152 booster assemblies overcome this limitation and the operational employment restrictions. The M151 and M152 consist of a booster, which contains only insensitive secondary explosives, and a length of low-powered detonating cord (5 grains/foot versus 50 grains/foot for high strength) with a high-strength booster in lengths of 10 feet and 30 feet respectively. As such, the low-powered detonating cord will not cut itself or other detonating cords if crossed.

The boosters at the end of the M151 and M152 assemblies look like blasting caps, but they are not blasting caps because they contain no primary explosives. Although the boosters have the same strength as #12 commercial caps, they can be treated like detonating cord because they contain only secondary explosives. The booster end piece (the part that looks like a cap) is added to the low-strength detonating cord to fit the system into standard military cap wells.

These new components provide the same functionality as the M11 and M16 blasting cap assemblies, but with expanded capabilities. The M151 and M152 have been fully tested in all primary missions, but there are no safety restrictions as there are on the M11 and M16. Also, when using the M151 and M152, it is safe to preprime and carry the demolitions.

New Equipment Training

The Maneuver Support Center (MANSCEN) Directorate of Training Development will ensure that all combat engineers receive new equipment training (NET), to include training on all MDI components and the M151 and M152 systems. Questions about NET should be directed to—

- Staff Sergeant Bob Watson, (573) 596-0131, extension 36299, *watsonb@wood.army.mil*
- Sergeant First Class Jeffrey Venus (Retired), (573) 596-0131, extension 37994, *venusj@wood.army.mil*

Future Demolition Modernization

Progress does not stop; therefore, the Engineer School continues striving to reduce the weight and volume of demolition systems to transition the Engineer Regiment to the Interim and Objective Forces. Future articles will describe the Demolition Modernization Plan for long-term Army requirements, which was presented in the Demolition White Paper sent to TRADOC and DA for approval. In the short term, improvements to the MDI will include versions of a new "minitube" system. The new components of the MDI will soon undergo developmental and operational testing. The target date for initial fielding of a new lightweight, low-volume minitube MDI system is the end of FY02.

The point of contact for information on demolition issues or to relay concerns from the field is Sergeant First Class Jeffrey Venus (Retired), U.S. Army MANSCEN, Directorate of Combat Developments, 320 MANSCEN Loop, Suite 141, Fort Leonard Wood, Missouri 65473-8929; commercial (573) 596-0131, extension 37994; DSN 676-7994, e-mail *venusj@wood.army.mil.*

Sergeant First Class Venus was a combat developer for demolition items at MANSCEN when he wrote this article.

Improving the Technical Skills of the Combat Heavies

By Sergeant First Class Carl L. Lindsay II

What do we expect of our combat heavy engineers in today's force? That question would have as many different answers as people asked. Combat heavies have been used extensively in humanitarian roles and in the Gulf War where they performed numerous tasks. In this article, I address the technical expertise that is expected of these units and what I believe is the true level of expertise.

Combat heavy units have carpentry, masonry, plumbing, and electrical specialists, as well as light and heavy equipment operators and construction supervisors. Looking at the makeup of construction units, you basically see a construction company. The problem we face is that soldiers have very little technical proficiency to perform the skills to the level necessary. Most of the experience in these units comes from the soldiers' background—for example, from a vocational school. While this is a good resource, it should not be the crux of the technical expertise.

With the specialties that are in these units, the personnel should be able to accomplish any construction mission. While at their home base, the units could take on several troop construction projects if the technical skills were developed. With the cutbacks that the directorates of public works have faced, these units could be valuable assets to the installations.

Seeing the problem is easy; improving an existing asset to solve the problem is the challenge. I would not want to present this solution as an overnight fix to this challenge but rather as an opportunity to use the asset that could prove to be invaluable. Some of the actions we could take to improve the technical proficiency of the combat heavies follow.

The U.S. Army Corps of Engineers (USACE) offers several courses that would help improve the technical proficiency of the combat heavy soldiers and instructors, to include carpentry, masonry, plumbing, electrical, and earthwork. In addition, an instructor certification course would help us teach the materials during advanced individual training. USACE also offers advanced training that could be used to improve and enhance higher-grade skills at the basic and advanced noncommissioned officer's course levels.

We should try to implement a more vocational style of training for soldiers. This would require a longer training period and possibly some civilian support. However, the technical expertise gained would be a huge benefit. Also, the time has come to upgrade our sets, kits, and outfits to reflect what industry today uses when constructing. The benefits of this improvement would far outweigh the cost involved.

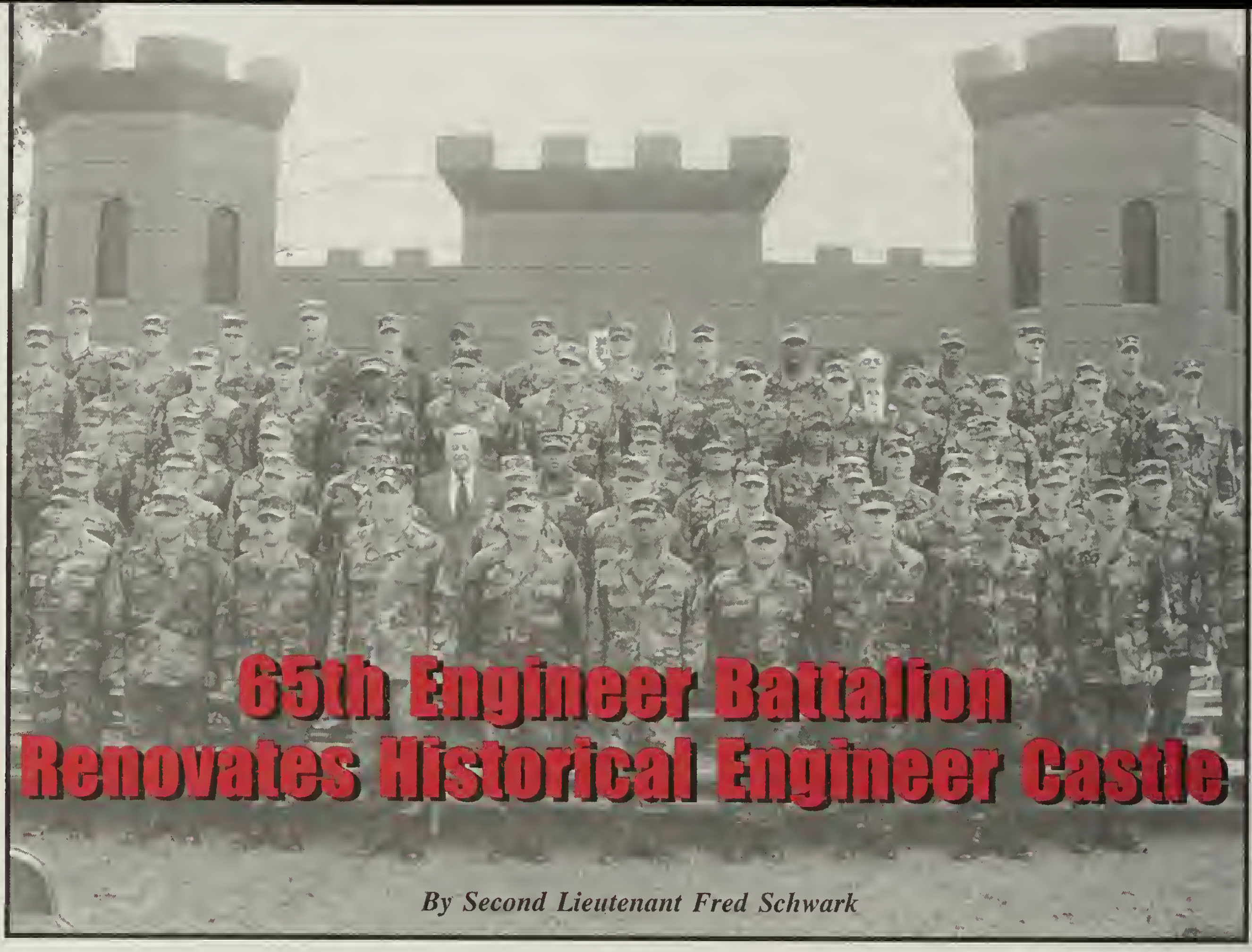
We also must better equip our battalion construction inspectors so they can perform their mission. As a construction inspector for USACE in Korea, I ensured that the quality of work met the standards of the specifications and blueprints for USACE projects such as constructing barracks, company operation facilities, and battalion and brigade headquarters. As an inspector, I had a wide range of tools available, to include the technical expertise of USACE. Battalion construction inspectors should have the same tools at their disposal; in most cases, they could get these through a local USACE office. Our inspectors could also attend advanced courses for certification, which would give us a better inspection process. It would increase the quality of work produced and give credibility to the work that a troop construction unit could perform.

We could use the USACE guide to develop specifications and testing procedures for troop construction projects. If these steps were taken, we could show the quality of work that is being performed and increase our value to the installation and the Army. And we should adopt the USACE safety manual—EM 385-1-1—as our safety and health requirements manual to establish safety standards that are the same throughout our units and consistent with USACE standards.

The biggest challenge that we face would also yield the greatest reward—engineers becoming a total team. Through the team-building process, units become more technically proficient, which will prove to be an asset for USACE also. Occasionally, USACE has had trouble filling positions quickly. In Bosnia, for example, the NCOs who were USACE inspectors were taken from Korea and Japan to fill the positions until civilian inspectors could arrive. When USACE is shorthanded at a location, we would be able to provide temporary inspectors. This would be excellent on-the-job training for the troop construction units and valuable assistance until the positions are filled. Another benefit from this training is that USACE would be training future employees to help fill the ranks of construction inspectors and project engineers.

We should not lose our focus; our mission in the combat heavies is to perform combat-engineering tasks, as well as the heavy construction missions required in a theater of operations. I believe that at the same time we can become a more technically proficient unit and a greater asset to the Army. I also believe that improving technical skills encompasses the synergy that the Chief of Engineers is seeking—for when we look at these improvements, it is truly a win-win situation.

Sergeant First Class Lindsay was a quality assurance representative in the Far East district, USACE, Camp Humphreys, Korea, when he wrote this article. He is now a platoon sergeant in the 46th Engineer Battalion, Fort Polk, Louisiana. He holds an associate in general studies from Cameron University and is working toward a bachelor's degree in business management.



65th Engineer Battalion Renovates Historical Engineer Castle

By Second Lieutenant Fred Schwark

Sixty-seven years ago, members of the 3d Engineer Combat Regiment, Schofield Barracks, Hawaii, began construction of an engineer castle to be part of a stadium on Ralston Field. The structure served as a grandstand as well as a symbol of the Corps. Years of weathering and neglect left the castle in dire need of attention.

In October 2001, veterans of the 25th Infantry Division (Light) met for their 60th anniversary reunion at Schofield Barracks. It was during this reunion that the 65th Engineer Battalion ran a rifle range for the veterans, who met and reminisced about their days at Schofield Barracks and the mighty castle on Ralston Field. While on the range, two of the veterans donated a few pictures of the 65th Engineer Battalion from 1941, standing tall in front of the castle. This sparked interest in renovating the castle.

Members of Second Platoon, B Company, 65th Engineer Battalion, 25th Infantry Division (Light), volunteered to renovate this symbol of pride and began work on 28 December 2001. First, they used scrapers and basic paint tools to remove the old paint, and then they used a pressure washer to get the rest of the paint off. Two weeks and almost 10 gallons of Engineer Red paint later, the castle had been brought back to life. The end product brilliantly reflects their hard work, and the finished castle remains a testament to the soldiers who built it 67 years ago.

Soldiers paint the castle on Ralston Field.

In a special ceremony on 13 February 2002, three veterans of the 65th Engineer Battalion from 1941 returned to Schofield Barracks to participate in the rededication of the castle. The veterans were in the 65th during one of the most turbulent times in American history. Months before the infamous day of 7 December, they stood tall with their companies in front of the engineer castle. Not knowing what the future held for them, they trained for their eventual deployment to the Philippines.

The veterans' stories of duty, honor, and country rang a chord within the soldiers of today. Maurice Storck came to the 3d Engineer Regiment by way of the Maine National Guard, which he joined in April of 1937, just shy of his 15th birthday. In 1940, he was transferred to the regular Army and assigned to B Company, 3d Engineer Regiment. Camellus Cappelluzzo, or "Cappy" to his comrades, joined the Army in July 1940 at the age of 17. In November 1940, he was assigned to the 3d Engineer Regiment. Bing Kow was drafted in March 1941 in the second peacetime draft. After basic training, he also went to the 3d Engineer Regiment as part of a group of men who replaced those who had already been sent to the Philippines. In the fall of 1941, the Old Hawaiian Division was formed into the 24th and 25th Infantry Divisions. Likewise, the 3d Engineer Regiment was reorganized into the 3d Engineer Battalion, which supported the 24th Infantry Division, and the 65th Engineer Battalion, which supported the 25th Infantry Division. All three of these veterans became part of the newly formed 65th Engineer Battalion.

This castle serves as a link between these warriors of the past and the soldiers of today. In October of 1941, the newly formed 65th Engineer Battalion had company pictures taken in front of the Ralston Field castle. Sixty years later, the 65th Engineers once again came to take company pictures at this castle. Although the original picture has faded with age, the same engineer spirit and determination are evident in both pictures. Essayons!

The Engineer Castle History

Strength, pride, heraldry, prestige, and honor. The castle remains the premier symbol of the U.S. Army Corps of Engineers. The medieval castle is inseparably connected with fortifications and architecture. In heraldry, the castle and the tower are often used on coats of arms. In this country, the term "castle" has been applied to the strongest of our early fortifications, such as Castle Pickney in Charleston, South Carolina, and Castles Williams and Clinton in New York Harbor. The castle is a highly stylized form without decoration or embellishment.

The Army unofficially adopted the castle to appear on the Corps of Engineers epaulets and belt plate in 1840. Soon afterward, the cadets at West Point—all of whom were part of the Corps of Engineers until the Military Academy left the charge of the Chief of Engineers and came under the charge of the Army at Large in 1866—also wore the castle on their cap beginning in 1841. Subsequently, the castle appeared on the shoulder knot, on the saddle cloth, as a collar device, and on the buttons. Finally, in 1902 the castle was formally adopted by the Army as the insignia of the Corps of Engineers. Although its design has changed many times since its inception, the castle has remained the distinctive symbol of the Corps of Engineers.

Second Lieutenant Schwark is the Adjutant of the 65th Engineer Battalion, Schofield Barracks, Hawaii.

(The Real Army, continued from page 35)

developed to support the AirLand Battle tactics. New organizations were designed to handle the new equipment and tactics. But I never actually saw these units come into being. After 3 years, I gave up on ever finding the Real Army and was transferred to a Reserve Officer Training Corps assignment.

As the Professor of Military Science at a university, it was hard to describe to my students what the Real Army was like, having never seen it myself. My only hope was that one of my young students would take up my torch, search for the Real Army, and one day find it. Although I retired without ever fulfilling my quest, I now had time to reflect and put things into perspective, which is what retirees do I am told. And I have reached these conclusions:

- There is no perfect army. Not really. Never was, never will be. That theoretical Real Army—at 100 percent strength, with 100 percent operational new equipment, and that is well-trained—doesn't exist except in military classrooms.
- The Real Army is an ideal, a goal. It is what could be. You don't seek it, you create it. It means being "All You Can Be, An Army of One"—doing your best, going the extra mile, and doing the extra push-ups. Okay, so your unit is not the best. Why not? What are you doing about it? Will it be a better unit because of you? It had better be!
- It is all the Real Army, every bit of it. There is only one Army, and you are in it. It may be like the five blind men feeling different parts of an elephant for the first time, but it is all one Army. It doesn't matter whether you are in Europe, Korea, Alaska, or stateside. It is not important whether you are airborne, ranger, mechanized, light infantry, armor, or aviation. It is the same Army doing the same mission. You are just seeing a different part of the Real Army. It is all too real.
- The Real Army is the people in the Army. It is as true today as it was at Valley Forge. It is made up of real people, fighting men and women. They are the greatest people on earth. Everywhere I served, I found real people doing a real job serving their country. I may have run out of fuel or bullets, or wished for better equipment, or thought the training and skills were lacking, but the people never once let me down. Not once! It was the soldiers who got the job done in spite of any hardships.

I am convinced that the best-equipped, best-supplied, and best-trained army will fall to pieces in a conflict if it doesn't have the best people. I spent my whole career looking for the Real Army—only to discover that it was always there, just outside my tent. I rest easy in the knowledge that it will always be so.

Lieutenant Colonel Anderson was assigned to the 82d Airborne Division, 101st Airmobile Division, 15th Infantry Battalion Mechanized/3d Infantry Division, 2d Infantry Division, and the Pentagon (DCSOPS). He is a graduate of the United States Military Academy, the Armor Officers Advanced Course, and the Command and General Staff Course and holds a master's degree from Indiana University.

The Evolution of the Engineer Force: Part II

By Dr. Larry Roberts

This is the second of a two-part article. Part I (Engineer, April 2002, page 44) covered force structure during World War I, the interwar period from 1919-1941, World War II, and the period from 1946-1950. Part II begins with force structure during the Korean War and continues through the 20th century, to include Vietnam, Desert Storm, and the Engineer Restructure Initiative (ERI).

Korea

The outbreak of hostilities in Korea in June 1950 tested the new engineer structure. However, it was a flawed test. The first engineer units, especially the first units deploying to Korea from Japan, were severely undermanned and inadequately equipped. The postwar demobilization of the Army had cut deeply into the manpower of divisional and nondivisional organizations. It was not until 1951 that engineer units in Korea had anything close to their authorized strength. Equipment available in the Far East was largely left over from World War II and in poor repair, if not totally worn out. New equipment from the United States had to compete with other items for space in the storage holds of naval transports. Korea was in every respect a "come-as-you-are" war. The American Army, and the Corps of Engineers, was not prepared for the conflict.

There was one other aspect of the war in Korea that tended to blur any determination of the viability of the engineer force structure at that time. Korea was not seen as the most strategically important area in the contest between the democracies and communism. Senior military commanders and the National Command Authority continued to see Europe as the most critical strategic area. Indeed, a number of Army units, to include engineers, were sent to Europe during the period of hostilities in Korea to reinforce the North Atlantic Treaty Organization and deter any Russian move to the west. This overtaxed the armed forces and forced a partial mobilization of Reserve Component units.

Engineers sweep for mines in advance of armor in Korea.

It is possible, however, to glean some basic facts concerning engineer force structure from operations in Korea. First, the divisional engineer battalion, even with its post-World War II augmentation, was still not capable of handling the engineer work in the division. Numerous commanders in Korea noted the need to continue applying an additional combat engineer battalion asset to the support of the division. In some instances, this was for a specific operation, such as a river crossing. In most instances, it was to handle the massive amount of roadwork required. Unfortunately, the slow rate of deployments to Korea in the first 6 months of the war meant that there were often no additional battalions to call on. Those that did exist were often consumed by line-of-communication work. The 36th Engineer Combat Group spent its first 6 months in Korea performing the work of a construction or depot group at Pusan.

The second fact was that the distinction between combat and construction units blurred or even dissolved due to the demands of the time. As has been noted, the 36th initially performed the duties of a construction group. Conversely, the 84th Engineer Construction Battalion built defensive positions in the Pusan Perimeter during its initial days in Korea. Five of the construction battalions ultimately sent to Korea performed road- and bridgework in support of the three corps, a task more appropriate to a combat battalion-army or a specialized company, such as a light equipment or bridge company.

In spite of these facts, the lessons and experiences of the conflict in Korea, the general engineer force structure, and the doctrine for employing engineer units changed little in the early 1950s. The next major shift in force structure would be occasioned by a perceived need to shift the Army to a force capable of fighting on an atomic battlefield.

From Pentomic to ROAD

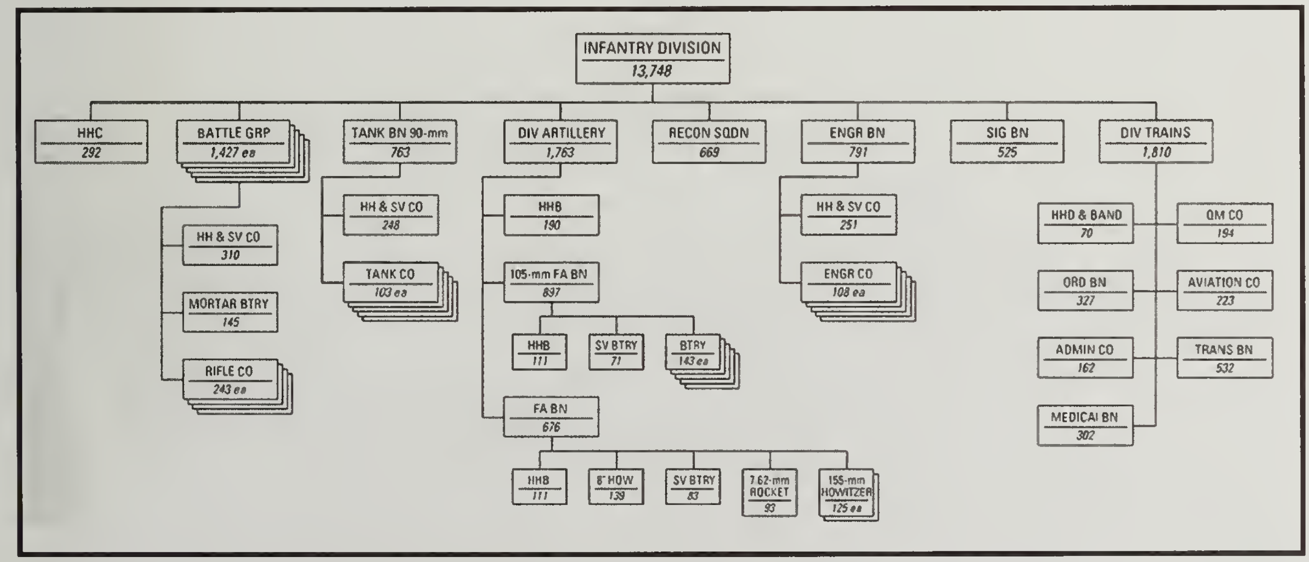
In 1954, Army Chief of Staff General Matthew Ridgway directed a review of the Army's organizational structure with recommendations on the organization of the Army from 1960-1970. He wanted a mobile force, capable of fighting on both atomic and nonatomic battlefields, that took advantage of new technology. A United States Army War College study recommended a total departure from the triangular division. In its place, the study recommended a small division of approximately 8,600 men organized into five small, self-sufficient battle groups—a pentomic division. The division would be completely air transportable. In spite of vigorous opposition, Ridgway's successor, General Maxwell Taylor, approved the study in 1956. When the Continental Army Command completed final work on the pentomic division, it had grown to more than 13,000 officers and men. However, it retained the focus on the five self-sufficient battle groups.

The divisional engineer battalion was restructured into an organization with five lettered companies, each having two platoons. The battalion retained the bridge platoon but lost the assault platoon from the 1948 organization. In addition, each of the battle groups had an engineer platoon in the headquarters and service company of the battle group. This platoon was to furnish the pioneer engineer support (hasty repair of roads, trails, fords, and culverts), limited field fortifications and obstacle breaching, and demolitions support. The platoon had no heavy equipment. Bulldozers, cranes, graders, and other similar equipment were in the divisional engineer battalion. Although the divisional engineer battalions contained five companies, one per battle group, doctrine maintained that some of these companies had to remain under the control of the division engineer for general work in the division area.

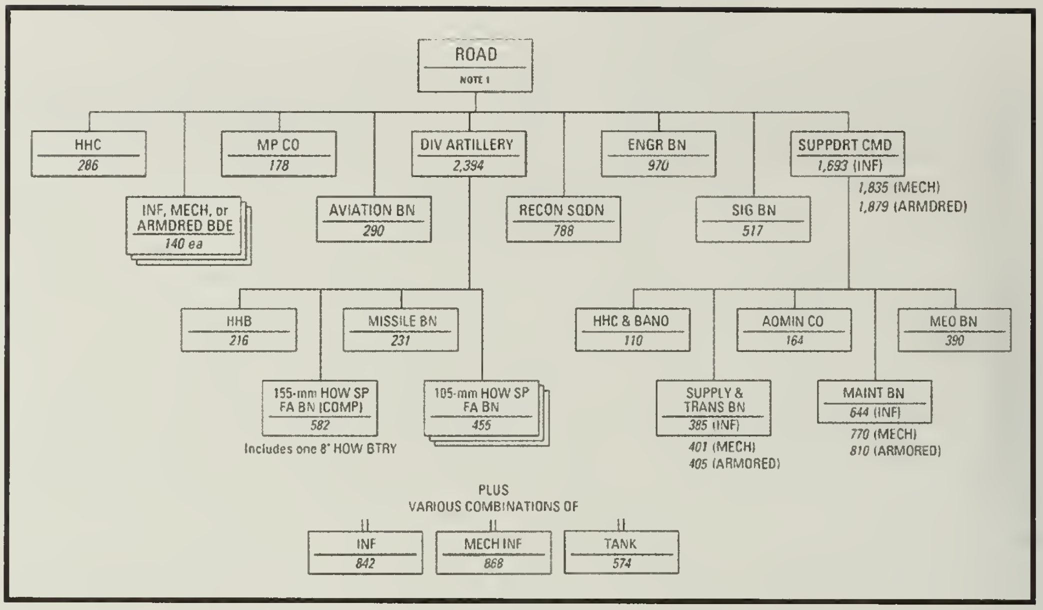
The projected force structure for a corps increased by a combat engineer group and three associated battalions, totaling three and nine respectively. The corps also added a panel bridge company, a float bridge company, and a light equipment company. There was a corresponding increase at field army level. The Department of the Army added a three-battalion engineer construction group and additional construction support—dump truck units. The field army's camouflage company became a camouflage battalion. The field army also retained its three-battalion combat groups.

The increase in the nondivisional engineer force reflected the orientation toward operations on a potentially atomic battlefield. The destruction of facilities and transportation possible in this type of environment required a robust engineer force. Doctrine still projected the reinforcement of divisional engineers by combat engineer assets at the corps. Construction engineering remained tied to the field army.

By 1960, the Army had reorganized most of its divisions according to the pentomic concept. However, opposition to the concept remained strong. Some believed that the divisional structure had to be sufficiently flexible to be tailored to certain tactical and geographical environments. A study entitled "Reorganization Objective Army Divisions (ROAD) (1961-1965)" was completed, even while the Army was completing its transformation to the pentomic structure. This approach, termed the ROAD concept,



Pentomic Divison



Divisional Base—ROAD Concept

reflected a thought process much like that which prompted the creation of the "group" versus the regiment. All divisions would have a common base of units, such as signal, transportation, and reconnaissance. However, the division's fighting elements—battalions and brigades—would be added or deleted as the tactical or geographical situation demanded. The ROAD concept was approved in late 1961. After delays occasioned by the Berlin Crisis and the Cuban Missile Crisis, the Army began reorganizing its divisions.

While the ROAD concept accepted the mixing of combat arms battalions according to tactical or situational needs, the generally accepted structure of a ROAD division had three combat arms brigades. In a sense, this returned the Army to the triangular division. For the engineers, the ROAD division was remarkably like the 1948 division. The basic difference was that the ROAD divisional engineer battalion had three letter companies and a bridge company in addition to the headquarters and headquarters company (HHC). The advent of the combat engineer vehicle negated the need for an assault platoon in the HHC. The tremendous increase in the number and weight of divisional vehicles increased the need for bridging, hence the strengthening of the battalion's bridging capabilities. Those units equipped with the mobile floating assault bridge had slightly fewer personnel than those using either the M4T6 or the Class 60 divisional bridge.

Under the ROAD concept, most of the Army's divisions were either armor or

A 3d Armored Division tank prepares to cross the Rhine River on a 12th Engineer Battalion raft (1959).

mechanized infantry. The airborne division was the only organization at this echelon that was specialized. The airborne division engineer structure went through all of the various restructurings from 1948-1962. Following World War II, the airborne divisional engineer battalion had three companies, each with three platoons of three squads. The headquarters company, in addition to normal signal and logistical personnel, had an equipment platoon and a bridge platoon. The aggregate strength of the unit was 753 officers and men. In the restructuring associated with the pentomic concept, the battalion trimmed down to two companies with four platoons each. It lost its bridge platoon and 280 personnel slots. Unlike the infantry battle groups, the airborne battle groups did not have engineer platoons embedded in the group's headquarters company. With the ROAD reorganization, the battalion gained almost 100 personnel, with most of the gain going to battalion headquarters. The three line companies had three platoons with three squads each. There was no appreciable change in basic equipment.

There were some changes in key nondivisional units. The engineer combat battalion-army (doctrine manuals now included corps) picked up a fourth company. In addition, the combat groups in the corps and field army contained four battalions instead of the three in previous force structures. While the number of groups per corps and field army declined to two and three respectively, the total number of combat companies at these levels actually increased. In addition, an engineer combat brigade headquarters was authorized at both corps and field army levels. Construction had a minor increase in personnel with no change in either their structure or mission. Construction battalions and groups remained focused on the communications zone. Doctrinally, none were found in the corps or field armies.

Vietnam

The nation's involvement in Southeast Asia marked a test, of sorts, of the ROAD concept. Generally, the three-brigade division was seen as sufficiently flexible to adapt to the requirements of unconventional warfare. Attachment of supporting organizations, especially aviation units, was well within the spirit of the ROAD idea. However, the divisions that did deploy to Vietnam were largely mechanized or light infantry divisions. No armored divisions went to Southeast Asia, although smaller armored units did serve in the theater. The 1st Cavalry Division, reorganized as an airmobile organization, was the only nonstandard unit of that size in the country.

Engineers descend from a Chinook helicopter in Vietnam.

Vietnam cannot be seen as a total affirmation of the ROAD concept. This was due to the fact that the Army, especially the engineers, did not fight according to doctrine—even the emerging unconventional warfare doctrine of the time. The major reason for this was the limitations on the numbers and types of engineer units that could be deployed to Southeast Asia. Major General Robert Ploger, the senior engineer in Vietnam and first commander of U.S. Army Engineer Command-Vietnam, noted:

> "*Early planning for the buildup and operations in Vietnam had little more to go on than tentative indications of the number of maneuver battalions that might be deployed. There was no generally accepted tactical concept, campaign plan, or scheme of logistical support upon which effective engineer planning could be based.*"

When senior Army leaders did begin to appreciate the magnitude of the engineer requirement, political decisions forced the Army to make nondoctrinal adjustments. At that time, 50 percent of the Army's engineers and engineer equipment was in the Reserve Components. However, the nation's leaders decided against a selective call-up of Army Reserve or National Guard personnel. This, coupled with the continuing demand for forces in Europe to deter the Warsaw Pact, meant that senior engineer officers had to send CONUS units to Vietnam in spite of their organizational type. Consequently, the engineer force in Vietnam, at its peak, had two brigade headquarters, six group headquarters—of which only one was a combat group headquarters—and 28 nondivisional battalions. Thirteen of these battalions were combat battalions; the remaining 15 were construction battalions. This engineer force was in addition to the organic engineers of the seven divisions and seven separate brigades deployed to Vietnam.

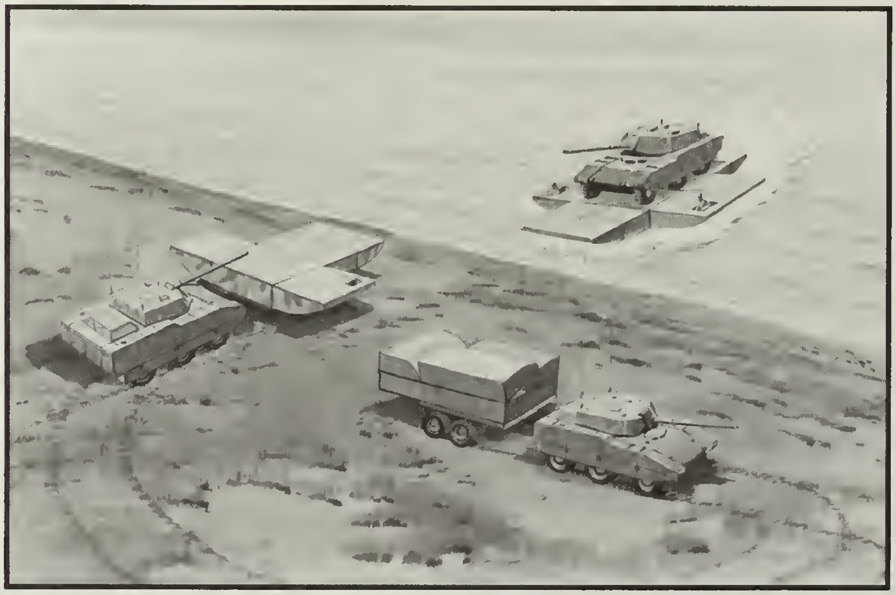
The nature of operations in Vietnam tended to negate established engineer doctrine and its associated force structure. The need for both combat and construction engineer support meant that both combat and construction units did both tasks. The traditional practice of placing a combat engineer battalion in support of a division was also modified. In the first place, the supporting battalion might be a construction battalion and not a combat battalion. Second, the tactical situation and the mobility offered by the helicopter could result in different battalions providing support at different times.

MG Ploger noted that maneuver units using helicopters were far more mobile than their engineers. Consequently, operational support came from whatever engineer unit was closest to the area of operations. Ploger went so far as to subdivide South Vietnam into operational areas for his groups. These groups, and their battalions, supported whoever entered their area. This was in addition to tasks directed by higher headquarters, such as improvements in the lines of communications and airfield construction.

Airmobile operations were the major tactical innovations associated with the Vietnam War. The 1st Cavalry Division was the Army's first division structured around the airmobile concept. From an engineer standpoint, this division was analogous to the airborne division. Neither had the ability to move heavy equipment. Therefore, these engineers relied on light dozers and engineer equipment. The airmobile division engineer battalion was larger than its airborne counterpart by 150 men. The difference was found in a fourth letter company and an additional equipment platoon in the headquarters company.

1975-1990

Although the 1st Cavalry Division had validated the airmobile concept and ensured its place in future force structures, the Army turned its attention back to Europe and heavy forces in the years following Vietnam. The continuing perception that confrontation with the Soviet Union remained the greatest challenge explained part of this orientation. A second factor was the Yom Kippur War. In the midst of the American Army's efforts to create lighter and more mobile forces, such as the 1st Cavalry, the Middle East erupted in a conventional war characterized by armored and mechanized war on a level not seen since World War II.



Light Assault Raft

In 1975, the Department of the Army directed the Training and Doctrine Command (TRADOC) to analyze the heavy division. The basic premise was that technology had been applied as "add-ons" rather than doctrinally incorporated into the structure and war-fighting doctrine of the division. The advent of the "active defense" concept reinforced the need to reexamine the role and organization of the heavy division. The objective was to apply new technology, primarily in the form of new weapons and support systems, to achieve greater mobility, firepower, and maneuverability. The resulting Division Restructuring Study recommended several changes in the composition of the division. One of the recommendations was to remove the bridge company from the engineer battalion and move it to the corps. This suggestion was somewhat puzzling. An increase in the weights of divisional equipment—especially armored vehicles—and the need for greater maneuverability logically argued strongly for the retention of the bridge company. In addition, the survivability of divisional forces, an obvious facet of the reality of fighting "outnumbered," should have called for additional engineer assets.

Parallel to this reevaluation of the heavy division was the Army's attempt to respond to the congressionally mandated requirement to alter the "tooth-to-tail" ration. A number of analysts and congressmen believed that the support forces in the Army had grown out of proportion to the combat forces. This reinforced the desire of General Creighton Abrams, the Army Chief of Staff in the early 1970s, to eliminate everything in the active Army that did not contribute directly to the fighting force. The Corps of Engineers responded in two ways. First, it changed the designation of its construction battalions to "combat heavy battalions." Second, it shifted a number of corps and echelon-above-corps support functions to the Reserve Components.

The fruits of the Division Restructuring Study were short-lived. In 1979, General Don Starry took command of TRADOC. He rejected the idea of "active defense" in favor of a reorientation on offensive operations. This ultimately led to the advent of "AirLand Battle." With a new doctrinal philosophy, TRADOC reexamined the heavy division in an effort known as Division 86. At the same time, TRADOC took on a directed task to standardize infantry, airborne, and airmobile divisions. The issue here was to field a force capable of rapid deployment, but with sufficient firepower and resources to sustain itself in combat. As was the case in the Division Restructuring Study, planners looked to technology to add new capabilities to the combat force.

Although the Army adopted a "final form" for the heavy division in 1982, the actual conversion of armored divisions was deferred until the mid-1990s. Reductions in personnel made it difficult, if not impossible, to fill the 18,000 to 20,000 personnel slots in the various forms of the division. In addition, the new division incorporated more than 40 new weapons or pieces of equipment, some of which were still in the developmental stage. The solution was to adopt interim organizations until such time as the materiel was available. The divisional engineer battalion reflected this approach. The structure called for an organization of four letter companies, a bridge company, and a headquarters company. The line companies were authorized the M9 armored combat earthmover (ACE). Unfortunately, the M9 had not been fielded. This, plus personnel constraints, meant that interim organizations with reduced manpower (to include the absence of the bridge company) and substitute (often obsolete) equipment would be the norm for the foreseeable future.

There was no final form for the "light" divisions. General Starry set a cap on the size of the unit at 14,000 personnel. In addition, the new division would not have organic tank or mechanized infantry units. More importantly, he specified that the unit had to be deployable in C-141 transports. In this latter case, Starry departed from one of the basic design principles that had guided Army planners for most of the 20th century. Force structure had always had as its guiding principle the ability of the organization to perform its function in combat. Starry added, or conceivably substituted, the ability of the unit to get to the area of operation. In this respect, Starry's action was remarkably similar to Army leaders of the post-World War I period who sought to trim the division based on the road space it occupied or the number of ships needed to get it overseas. In this sense, mobility was not the same as maneuverability; mobility was in fact deployability.

This idea carried over into the next phase of force design that came to be known as the Army of Excellence. The new Chief of Staff, General John A. Wickham, wanted light divisions to be deployable three times faster than existing infantry divisions. He also wanted the light division to be totally transportable in fewer than 550 C-141 sorties. Based on this criteria, planners designed a division of slightly more than 10,000 men. The divisional engineer battalion had 314 officers and men, organized into a headquarters company and three line companies. At full strength, each of the letter companies had 63 officers and men. The headquarters company had an assault and barrier platoon with small emplacement excavators and M9 ACEs. Indeed, all of the unit's earthmoving equipment was consolidated in the headquarters company.

General Wickham's desire to reduce the size of the light division carried over to the airborne, airmobile, and motorized divisions. The engineer battalion was reduced to approximately 400 officers and men for the airborne and airmobile battalion. The motorized division engineers numbered 490. The engineer structure for the motorized division represented a significant departure from traditional designs. The battalion had three light and one heavy company. The light companies had three, two-squad platoons and a mine/countermine section. The heavy company had one standard platoon of two squads, a mobility platoon with ACEs and light assault bridges, and a countermobility platoon oriented to mines and antitank ditches.

Ironically, all of the effort at designing a motorized division that reflected the latest technological innovations came to naught. The division's structure, and to a degree its method of operation, depended on the acquisition of the new equipment, such as assault guns and fast attack vehicles. However, the money for the acquisition of those systems never materialized. Consequently, the Army had developed a specific type of division that it ultimately could not field because it could not purchase the equipment unique to that organization.

Desert Storm and the ERI

In late 1990 and early 1991, the Army deployed a significant part of its force structure to the Persian Gulf in response to the invasion of Kuwait by Iraq. The forces included armor, mechanized infantry, airborne, and airmobile organizations. These units brought with them a variety of organizational structures implemented under the Division Restructure Study, Division 86, and Army of Excellence programs. Most of these had been established to deal with a principal threat of conflict in Europe against the Soviet Union. However, the demise of the Soviet Union cast large questions about the proper structure and composition of Army units.

The engineer force that operated in Southwest Asia was not one approved in the conventional force structure process. Since the mid-1980s, the engineers had advocated a fundamental change to the 50-year rule of limiting divisional engineer assets to a battalion. The Engineer School commandant recognized the need for an engineer brigade in the armored and mechanized infantry divisions. This was initially called E-Force and would ultimately become ERI. This concept called for three divisional battalions under the command and control of a divisional engineer brigade commander. Although the concept had

M9 Armored Combat Earthmover

been approved at several levels and had been tested in various exercises, it had not been formally adopted by the Army. The Central Command commander approved the formation of ERI "brigades" in four of the five divisions deployed to the Persian Gulf. Engineer brigade commanders and staffs were formed as ad hoc organizations with personnel drawn from a number of sources. In one case, the supporting engineer group commander assumed command authority over the three battalions in the division (the original divisional engineer battalion and two corps assets). For the most part, the new divisional battalions were corps units. While the ERI concept was successful, some engineers suggested that an operational environment was not the place to test new organizational concepts and that the hastily assembled divisional brigade command and control elements could have encountered significant problems. The shortness of Operation Desert Storm meant that many of the potential problems of the ERI did not have time to surface.

In March 1991, the Army Chief of Staff approved the ERI for implementation across the Army. This constituted a rather unique situation where the Corps had developed an organizational structure and "sold" it to the Army. Historically, engineer planners have been part of a larger group of individuals examining organizational structures and arriving at integrated recommendations.

However, the ERI would suffer from the same circumstances that negated adoption of the two-battalion regiment in the days following World War II. A continuing move to reduce the manpower strength of the Army and the application of scarce resources to other programs, such as modernization, prompted a continuing number of inactivations. In addition, the reorientation of the Army from a forward-deployed force to a CONUS-based force placed an unusually high premium on the ability to deploy to a distant region in a reasonable amount of time. As had happened in the past, the ability to meet certain deployment criteria became, in some instances, a factor more important than the ability to perform required missions or tasks once in the area of operations.

Conclusion

For most of the 20th century, engineers have tried to develop force structures that enable them to meet their mission responsibilities. Those responsibilities have remained relatively constant through time. While planners and developers from the 1920s, 1950s, 1970s, and 1990s have used different terms or phrases to define mission requirements, the challenge of the engineers has consistently been to facilitate the movement of the combined arms, impede the movement of the enemy force, and construct those works which allow for the physical and logistical support of the field force. Technology has changed the physical characteristics and capabilities of the equipment the engineers use, but it has not altered the purpose of engineer work.

The evolution of engineer forces in the last 80 years has shown certain recurring trends. First, the division has been the central focus for Army planners throughout the 20th century. For engineers, the capabilities and limitations of divisional engineers have significantly affected the composition and structure of corps engineer units. Lack of sufficient organic engineers in the division has forced planners to push corps engineer units into the divisional area to accomplish needed work. This has, in turn, forced the forward displacement of engineer units in echelons above corps to the corps area to cover requirements. This constituted a "work-around" approach that actually became codified in engineer doctrinal publications. The second fact is that while maneuver commanders have generally clamored for more engineers during combat operations, this need has often been forgotten when postconflict demobilizations and reduced budgets required manpower caps on divisional and nondivisional units. Finally, engineer planners have generally based their organization structures on the nature and quantity of work to be done in a given area. However, Army planners have often been influenced by the dictates of deployability and unique operational requirements. The pentomic division, and its focus on an atomic battlefield, was an illustration of the latter.

The challenge for engineer force planners in the future will be to educate the senior Army leadership on the nature and scope of engineer work across the operational spectrum. These same planners must then craft an engineer force with whatever manpower and equipment resources the Army is willing to provide.

Dr. Roberts is the U.S. Army Engineer School historian at Fort Leonard Wood, Missouri.

Combat Maneuver Training Center

Editor's Note: The article below describes well-refined tactics, techniques, and procedures for using an engineer reconnaissance team (ERT) while fighting in compartmented terrain at the Combat Maneuver Training Center (CMTC). Many engineer commanders in the field use a similar ERT concept to improve the quality of engineer reconnaissance information and more fully integrate mobility/countermobility/sustainability priority intelligence requirements into the supported unit's reconnaissance and surveillance (R&S) plan. Readers should understand that ERTs are not resourced in unit modified tables of organization and equipment and that the use of ERTs is not taught at the U.S. Army Engineer School as a doctrinal approach. Certainly, real innovation comes from the field and often turns into doctrine. But we need to be disciplined in our approach so these innovations complement and do not undermine existing tactics. As always, we encourage our readers to continue submitting articles as such and share ideas that build upon our warfighting skills.

Engineer Recon Teams

By Captain Gerald Dull and Sergeant First Class Danny J. Petersen

Engineer battalions deploy to the CMTC with the intent of using ERTs to gather engineer-specific intelligence on the battlefield. An ERT is an excellent asset when used appropriately.

It is important to understand the concept of an ERT, given that the current engineer force structure does not provide personnel dedicated for reconnaissance purposes. Although a battalion may choose to use more assets for reconnaissance, the ERT is the base engineer recon element. Its arrival method may vary from dismounted (air insertion or ground) to mounted (wheeled or tracked). An ERT can vary from three to five people, depending on whether they will be mounted or dismounted. A mounted recon consists of five people. An assistant recon team leader and a vehicle operator remain with the vehicle and the other three conduct the recon dismounted. The recon team leader typically moves with the dismounted element. The mounted element's primary mission is to maintain communication with the dismounts and the supported unit. Its secondary mission is to be prepared to go forward and conduct a recon if the dismounted element is unsuccessful. The dismounted element's mission is to report all information required by the supported commander, according to the R&S plan. It reports directly to the supported unit's headquarters or, if part of a mounted recon, it can relay information to the supporting mounted element. Generally, ERTs are tasked to locate and recon obstacles and restrictions along a route or an axis. This article examines the steps necessary for obstacle reconnaissance.

An ERT's purpose is to determine the best method to overcome the effects of obstacles, either through bypass or reduction. The ERT and engineer battalion must understand the five steps to a successful engineer recon mission:

- Detection. An ERT must help locate and evaluate obstacles and restrictions, and this begins during the brigade and/or task force intelligence preparation of the battlefield process. This process focuses the ERT on a particular named area of interest (NAI) or obstacle to recon. The ERT combines this effort with the work conducted during its troop-leading procedures (usually a map recon) to identify all possible obstacles and restrictions within its area of operation. It then uses this information to plan and conduct its mission.
- Area Security and Recon. Once the ERT detects an obstacle, it establishes an overwatch position and confirms the enemy situation from the nearside. Once the enemy situation is confirmed, the ERT establishes an observation post on the farside to provide 360 degrees of security around the obstacle.
- Obstacle Recon. Once security is established, the ERT determines obstacle location and orientation; type of mine or obstacle; obstacle length and width; existence of enemy coverage, including enemy strength, equipment, and fire power; and equipment necessary to reduce the obstacle.
- Course of Action (COA) Selection. The ERT has four basic COA options: bypass (preferred), reduce the obstacle (least preferred as it significantly degrades its abilities), support a breaching operation, or continue the mission. Initial guidance for COA options is generally found in paragraph three of the base operations order (OPORD) or in the R&S plan. After collecting the facts, the ERT leader analyzes the COA and mission, enemy, terrain, troops, time available, and civilian consideration factors to select the best COA.
- COA Recommendation/Execution. After selecting a COA, the ERT leader either makes a recommendation to higher headquarters or executes the COA. Many times he will execute a COA based on prior guidance from the OPORD.

To accomplish these tasks, the ERT can be employed using one of three methods. The first method is to integrate the team as part of the brigade intelligence-collection effort. This employment concept may be used when engineer scouts are not expected to work closely with task force scouts or there are advantages (such as observing enemy obstacle emplacement) to moving the ERT across the line of departure before the task force scouts. Typically this is how the engineer battalions employ their ERTs at CMTC as they task-organize an ERT with a brigade recon troop (BRT). It requires the most involvement by the engineer battalion; it is also where units generally fail. Because the engineer battalion is not very involved, the BRT uses the ERT as observation posts or radio/telephone operators, since the BRT commander, without clear guidance, uses the ERT to best support his mission. To avoid this problem, the engineer battalion must ensure that the ERT is included in the brigade intelligence-collection plan by stating tasks in the R&S section of the brigade OPORD. It must also actively track the ERT's logistics status, position, and no-fire areas and ensure that intelligence gathered by the ERT is disseminated.

The second method is to assign the ERT brigade's NAIs in a task force area of operation. The ERT then receives its objectives through the engineer battalion via the brigade OPORD. It is imperative that the ERT team leader links up with the task force scout platoon leader and gets integrated into the task force plan. He should attend all task force scout OPORD briefings and rehearsals.

The third method is for the ERT to work under a task force's control. This requires the least amount of coordination and planning for the engineer battalion. The activities of the ERT fall on the task force engineer, who is now responsible for using the ERT and integrating it into the R&S plan. He is also responsible for the ERT's logistics status, tracking its position on the battlefield, establishing no-fire areas, and disseminating the ERT's reports from the engineer tactical operations center to the engineer battalion.

No matter which employment method is chosen for the ERT, selecting the proper personnel and equipment is critical to the success of the ERT. When making these selections, the engineer battalion must be aware of the trade-offs in using assets in a recon role as opposed to a maneuver-support role. The loss of personnel and equipment can degrade the battalion's capabilities. A primary consideration in selecting personnel rests with the training required to make them successful at their task. A large amount of time must be devoted to training, and the battalion staff and ERT members should be trained in the six fundamentals of tactical recon operations:

- Use maximum recon forces forward; do not keep them in reserve.
- Orient on a recon objective. All personnel should understand the purpose of a recon mission, which is found in priority intelligence requirements, the R&S plan, and the commander's intent.
- Report all information rapidly and accurately. The ERT needs to report what it sees on the ground and not what it thinks the higher commander wants to hear. Information that an obstacle is not in a templated location is just as valuable as information on where an enemy or obstacle is actually located.
- Retain freedom of maneuver. The ERT must be able to maneuver on the battlefield.
- Gain and maintain enemy contact. Once contact is made, the ERT must maintain it using all means available.
- Develop the situation rapidly. Time is a precious commodity; soldiers must be able to accomplish their tasks with a minimum of guidance from higher headquarters.

Besides executing the fundamentals, it is vital that the ERT is able to effectively operate with brigade assets and task force scouts in a habitual relationship. Trust and familiarity must be developed at the home station before a rotation. In many instances, a CMTC rotation is the first time the ERT has trained with the BRT or task force scouts. The soldiers must also become proficient in basic soldier tasks, including reporting, calling for fire, first aid, noise, light, and litter discipline. Finally, the members of the ERT must conduct rigorous physical training to ensure that they have the endurance to complete the dismounted missions.

Training is only part of the equation for a successful ERT. The soldiers must also have adequate resources to ensure success. First, if they are to insert by ground, they must have a vehicle—which can be either a high-mobility, multipurpose wheeled vehicle (HMMWV) or an M113A3. At the CMTC, the HMMWV is the preferred mode of transportation as it offers greater stealth, is less maintenance intensive, and can travel in restricted terrain. Using an M113A3 is more desirable if the requirements call for more personnel and equipment or the need for survivability is a higher priority.

Outfitting the vehicles and personnel with proper communications equipment is vital to the ERT's success. The mounted element should have a minimum of two radios per vehicle. This allows them to act as a retrans or extend the range of the dismounted element's radio systems. The ERT should also have a manpack for the dismounted soldiers. Weapon systems should include an MK19 or M2 mounted on the vehicle; dismounted soldiers should have an M203 and a SAW/M60. Other recommended equipment includes night-vision devices, a global positioning system, a laser range finder, and a digital camera.

The ERT is an excellent asset if a unit can afford to resource it and understands how to use it. The ERT must be integrated into the R&S plan and home-station training with the BRT or task force scouts. If the ERT is equipped and properly used, it can be a combat multiplier through the intelligence it gathers. The OPFOR at CMTC uses the ERT effectively against the training units during every rotation, and we can do the same.

Captain Dull is the assistant brigade engineer observer/controller at CMTC. Previous assignments include commander, C/299th Engineer Battalion, and training officer, Engineer Brigade, 4th Infantry Division.

Sergeant First Class Petersen is the engineer battlestaff NCO observer/controller at CMTC. Previous assignments include combat engineer vehicle commander, 82d Engineer Battalion, and A&O platoon sergeant, 58th Engineer Company (OPFOR).

ENGINEER UPDATE

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Directorate of Training (DOT)

Counter-Booby Trap Course. On 28 May 2002, 18 Engineer Officer Basic Course students from Class 3-02, along with two first lieutenants from the 1st Engineer Brigade, Fort Leonard Wood, Missouri, participated in a pilot Counter-Booby Trap Course.

The purpose of the 2-week course was to train personnel to recognize, detect, report, and plan the clearance of booby traps. Students were introduced to a wide range of counter-booby trap topics, including uses and principles; switches; recording, marking, and reporting; and recon. They participated in various practical exercises that incorporated classroom training into real-life scenarios, while providing an opportunity to plan various booby trap clearance operations and conduct clearance exercises. Students used trip wire feelers; titanium probes; AN/PSS-12 mine detectors; DA Forms 1355, *Minefield Record*; and rolls of engineer tape for marking safe pathways. The intent of the course was not to turn lieutenants into subject-matter experts but to expose them to the many aspects of booby traps and enhance previous training.

The students were reminded regularly that all clearance missions should be conducted with the support of explosive ordnance disposal (EOD)-qualified soldiers. Trained experts on post, including instructors from the Department of Instruction at the Maneuver Support Center and the Sapper Leader Course, enhanced the quality of the course while offering students the opportunity to learn about real-life experiences. The course was capped off by a visit from EOD personnel from Fort Polk, Louisiana, who offered search advice and fielded questions.

Officials from the Directorate of Training Development are currently deciding on the course's future, making any necessary adjustments, and deciding at what level of leadership the course will be taught.

POC is CPT John Clarke, 35582; DSN –5582; or e-mail *clarkej@wood.army.mil*.

News and Notes

United States Military Academy (USMA) and United States Military Academy Preparatory School (USMAPS) Appointments. USMA at West Point, New York, is the world's premier institute of leader development. Graduates not only receive a bachelor of science degree but also a commission as a second lieutenant in the U.S. Army. They also gain practical leadership experience that is virtually unmatched in any other profession.

Each year, USMA or USMAPS at Fort Monmouth, New Jersey, offers admission to approximately 250 soldiers (Active, Reserve Component, and National Guard) and more than 100 military dependents. USMAPS prepares soldiers for success at USMA through an intensive curriculum focused on English and mathematics.

To be eligible, a dependent must be the son or daughter of a military member in one of the following categories. First are career family members. These are members of an armed force (Army, Navy, Air Force, Marines, or Coast Guard) who are on active duty (other than for training) and who have served continuously on active duty for at least 8 years or who died while they were retired with pay or granted retired or retainer pay. Second are service members currently serving in the Reserve Component who are credited with at least 8 continuous years of service computed under Section 12733 of Title 10, United States Code (for example, at least 2,880 points). Third are Reservists who are entitled to retirement pay when they reach age 60, including those who have died. Applicants must be—

- U.S. citizens.
- Unmarried with no legal obligation to support dependents.
- High school graduates.
- Under 23 years of age before July 1 of the year entering USMA (under 22 years of age before July 1 of the year entering USMAPS).
- Of high moral character.

Most importantly, the applicant must have a sincere interest in attending USMA and becoming an Army officer.

Soldiers and dependents who meet the basic eligibility requirements, have achieved SAT scores greater than 1,000 or an ACT composite score of 20 or higher, and have earned good grades in a college preparatory high school curriculum are especially encouraged to apply. All application requirements must be submitted by 1 April 2003 to be considered for appointment to USMA or USMAPS in July 2003.

POC is Captain Cliff Hodges at (DSN) 688-5780 or (845) 938-5780, e-mail: *tc2324@usma.edu*, or fill out the request form at *http://forms.admissions.usma.edu/cb*.

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COMMANDANT
MG R.L. Van Antwerp
563-6158
vanantwerpr@wood.army.mil

ASSISTANT COMMANDANT
BG Randal R. Castro
563-6192
castror@wood.army.mil

REGIMENTAL COMMAND SERGEANT MAJOR
CSM Robert R. Robinson
563-8060
robinsonr@wood.army.mil

DEPUTY ASSISTANT COMMANDANT
COL John (Pat) Leake
563-8080
leakej@wood.army.mil

DEPUTY ASSISTANT COMMANDANT – ARNG
LTC Robert McCabe
563-8046
mccaber@wood.army.mil

CHIEF OF STAFF
LTC Thomas E. O'Donovan
563-7116
odonovant@wood.army.mil

TRADOC SYSTEMS MANAGER for ENGINEER COMBAT SYSTEMS
COL John Holler
563-4081
hollerj@wood.army.mil

TRADOC PROGRAM INTEGRATION OFFICE - TERRAIN DATA
COL David Kingston
563-4086
kingstond@wood.army.mil

COMMANDER, 1st ENGINEER BRIGADE
COL James Rowan
596-0224
rowanj@wood.army.mil

DIRECTOR OF TRAINING
COL Jeffrey P. LaMoe
563-4093
lamoej@wood.army.mil

DIRECTOR OF ENVIRONMENTAL INTEGRATION
COL Robert S. Kirsch
563-4119
kirschr@wood.army.mil

DEPARTMENT OF INSTRUCTION
LTC Jeffrey A. Bedey
563-4129
bedeyj@wood.army.mil

CHIEF OF DOCTRINE
LTC Anthony Funkhouser
563-7537
funkhousera@wood.army.mil

HUMANITARIAN DEMINING TRAINING CENTER/COUNTERMINE TRAINING SUPPORT CENTER
Mr. Paul Arcangeli
596-3869
arcangelip@wood.army.mil

By Order of the Secretary of the Army:
ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:
Joel B. Hud
JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0226205

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UNITED STATES ARMY ENGINEER SCHOOL

COMMANDANT
Major General R.L. Van Antwerp

MANAGING EDITOR
Lynne Sparks

EDITOR
Shirley Bridges

GRAPHIC DESIGNER
Jennifer Morgan

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AT URBANA-CHAMPAIGN

Clear The Way

By Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School

It is really great to be back in BDUs. Army life is full of changes and challenges, and each assignment has its own rewards. But I am so pleased to be back at Fort Leonard Wood and, more importantly, back with the Regiment. Thank you all for the warm welcome and your tremendous support during the transition.

I have been walking the grounds of Fort Leonard Wood since July, and I am impressed with what I've seen—sappers training in the basics of soldiering and combat engineering, seasoned drill sergeants, bright-eyed lieutenants, tough captains as small-group instructors, and the list goes on. The dedication and hard work of the civilians and soldiers of the Engineer School inspire me, as I see the Engineer Regiment transforming before my eyes. I would like to thank MG Andy Aadland for handing over the reigns to such a superb organization and fantastic team. And, Andy, keep those TIM dollars coming!

The hard work of the part of the Regiment here also includes work toward transformation. That work is important, and the reason is simple—the world in which we live is changing. The United States is now in a world of regional instability, rogue nations, international crime, land mines, and terrorism. For those reasons, we must transform. But our Commander-in-Chief, President Bush, has also told the military forces to be ready. Two missions at once is tough business, but engineers are used to it. We've always succeeded at multiple missions; we support the maneuver force and accomplish the engineer mission.

Change is something that we do not do easily. We have not had a major change in engineer force structure since ERI. That was almost 12 years ago during the Cold War era. We have made some changes in the margins, but fundamentally we are organized, equipped, and manned and usually function in exactly the same way that we did when the Wall fell. However, there is one area where things have changed significantly—engineer actions across the spectrum of operations. From Bosnia to Afghanistan to a multitude of smaller operations, we have seen what I think is a fundamental shift. I see smaller engineer forces carefully selected and trained to accomplish specific effects in support of maneuver.

Let's look at an example. In the past, we just put combat heavy battalions or companies on the TPFDD; deployed them lock, stock, and barrel; and accomplished the mission. It didn't matter if it was HIC (Desert Shield/Desert Storm), SASO (Honduras, Fuertes Caminos), Grafenwohr, or NTC. The rule was "if it is green and on your property book, then you need it, every time, every place," and you took it with you. In some ways, we no longer employ and deploy in this manner. Engineer employment is planned and prepared at a variety of levels to build task-organized units that are tailored to minimize lift, minimize logistical footprint, and maximize effects. We deploy what we need and whom we need. We train them to a high state of readiness in the special skills they will need. And they accomplish their missions magnificently.

A significant goal for the Interim and Objective Force Army is that same deployability, responsiveness, and sustainability—maximum effects, minimum lift, and minimum logistical footprint. Overall rapid, decisive, and successful operations require this tailorability. There are a variety of things that are allowing this to become part of how we do business: superior information flow, improved intelligence, better command and control, and smarter and tougher soldiers and leaders. It is an important shift and one of several that I think needs exploring. I need leaders at every level to keep brainstorming new ways we can fight the engineer fight of the future. If you are not engaged in the future, then you are part of the past.

While transformation is the direction of the future of the Army, the key to the continued success of the Army is people. You are the future of the Engineer Regiment. You are the reason we have the most dynamic engineer force in the world. You are the reason I am so confident in the future successes of the Corps of Engineers. And this is the reason that all leaders—from myself down to each squad leader—must take care of their people. I want each leader to ensure that he takes care of his people by achieving a healthy balance —a balance of spirituality, family, and work. The context of that balance certainly changes, but the fundamental approach applies everywhere—garrison, field, and battlefield.

Think about the future, take care of your people through balance, and we'll talk again in upcoming issues.

Essayons!

Lead The Way

By Command Sergeant Major Robert R. Robinson
U.S. Army Engineer School

As you read this article, there will be a new Regimental Command Sergeant Major at the helm of our Regiment. CSM Bill McDaniel has been selected to replace me and will undoubtedly do a great job as the Engineer School Regimental CSM. And, in addition to my replacement being named, our Corps of Engineers will have a new CSM in CSM Mike Balch. I realize this is old news, but I'm very excited about the future of our Regiment and what these two super NCOs will bring to it. Their selections represent a new generation of leaders, with fresh ideas and experiences that will shape the Regiment's future.

As I wind down the time I have left in this job and in the Army, I have reflected often on how much has changed in the last two years and over the course of my 30-plus years of service. In the last two years, we have seen the transition of several of our Regiment's best leaders. As I have said in earlier articles, transition of leaders in our business is commonplace. But what we have to realize is that with the passing of every great leader, our Regiment gets better.

We have seen our Army transform. Organizations, equipment, and doctrine are very different today in a lot of places in our Army than they were two years ago. Here at the Engineer School, we have won, then lost—and in some cases won back—key battles with regard to organizations, personnel, and doctrine. Although some of the faces have changed, and will continue to change, the mission here at Fort Leonard Wood will always be to ensure that our Regiment is relevant and integral to the Army's transformation.

I have visited most of our engineer soldiers throughout the world, and I'm always impressed with their enthusiasm and professionalism when they perform their duties. Our soldiers are the busiest in our Army and are the busiest they have ever been over the last 30 years. I can remember an Army that, in the mid to late 70s, did nothing in comparison to what our operational tempo has us doing today. In the 70s and early 80s, we occupied our time and our soldiers' time by maintaining equipment that never got used and training on tasks until we were numb. And alerts—when we did use our vehicles to get to the local deployment or marshalling areas—were one-day events.

I also remember an Army where the leadership was weak and uncaring and, therefore, soldiers were unmotivated, undisciplined, and unprepared for combat. I can remember reporting to my first unit overseas and being approached by a person in civilian clothes offering to sell me drugs, only to find out the next day that this person was an NCO in my unit. And I remember being housed in a room with a couple of specialists who smoked so much hashish that I refused to sleep in the room and moved my bunk and locker into the hallway. I also remember, as a platoon sergeant, relieving all four of my squad leaders whom I caught drinking wine at 0530 hours, when their squads and the rest of the platoon were preparing to move to the field.

I am not naïve enough to believe that we have completely removed this kind of misconduct in our Army, but I feel secure in saying that it doesn't happen very often. Our Army is much better today because of the people who join it and our superb NCO Corps. The leaders of our Regiment today are quality people who care for and prepare our soldiers superbly. They are all outstanding and are training their soldiers to carry on with the highest of standards and traditions. The greatness of our Army lies in all its components—Active, Guard, and Reserve—and the component we most often forget—our civilian workforce. That is why I can leave the Army content in knowing that the future of the Regiment is in good hands.

I began my life as an Army engineer at Fort Leonard Wood, and it's appropriate that I retire here. This has been my home for more than 12 years of my career, and this place has been good to me and my family. I reminisce often about my days on the trail, working out on the ranges, and the other positions I've held here. I think a lot about all the soldiers I trained and how many of them are Sergeants Major and First Sergeants today. And, as ironic as it may seem, I can remember avoiding guys like MG Jack Waggoner and CSMs Baxter, Butler, Haller, and Allen, but now I look forward to seeing them every day.

In closing, I want to thank all of the leaders of our Regiment for your support—Commanders, Command Sergeants Major, Officers, and NCOs. You have all made my time here as the Regimental CSM rewarding and have allowed me to experience a dream I have had since I became an NCO. I have been blessed throughout my career, serving with and for great commanders. I would name you all, but I know you know who you are. I want to say, simply, "Thank you."

I would ask that you—and I know you will—give Bill McDaniel and Mike Balch the same level of support and faith in their abilities to do this work as you have me. Your trust and loyal support to them will make this arduous task fun. Essayons!

Engineers Lead the Way!

Sapper 7, OUT.

Base Camp Infrastructure Development and C2 in Afghanistan

By Major Dennis J. McNulty

The rapid and unexpected population growth that occurred at the base camp at Baghram, Afghanistan, and the expansion of base camps in general, presents challenges for engineer and logistical planners concerned with developing base camp infrastructure in an efficient manner.

Before Operation Anaconda, the base at Baghram, located approximately 30 miles north of Kabul, was not expected to exceed more than 300 personnel. Accordingly, engineer and logistical planners did not expect, nor plan, extraordinary life support or base camp construction tasks. As the situation developed, however, the camp population began to expand rapidly, and by mid-January, the population was hovering at about 1,000. Thirty days later, it had nearly doubled, and two weeks after that, the population was up to almost 3,500. By mid-March, the population had peaked at about 4,000. This rapid growth presented several challenges for engineer planners who were concerned about developing basic base camp infrastructure. Challenges such as providing bed-down, latrine, and shower facilities; potable water; and adequate power distribution had to be overcome at Baghram, as well as at the base camp at Kandahar. Establishing a base camp master plan and a command and control (C2) organization in the midst of the rapid expansion also proved challenging.

Bed-Down Facilities

Initial bed-down facilities for the first units arriving at Baghram consisted of a mix of old Russian barracks; standard general-purpose, medium tents; and Force Provider tents. As the camp expanded, more Force Provider facilities were added, and several buildings were renovated for

A UXO-littered field in Afghanistan

use as offices and limited sleeping quarters. Planners faced a major challenge in establishing bed-down facilities at Baghram because the area was heavily mined. The method used to clear areas throughout Afghanistan was dependent on several factors, including the known or perceived threat, the purpose for clearing, the assets available, and the terrain on which the clearing was required. In Baghram—as in Kandahar—large, flat areas were available and designated for tent cities. In most cases, these areas were cleared with a mine-clearing armor-plated D7 dozer, or an Aardvark or a Hydrema flail, and then visually proofed. Mine-detection dogs were also used for additional proofing. (See article, "Repairing Runways and Clearing Mines in Afghanistan," *Engineer*, July 2002.)

Another issue faced by planners at Baghram was that initially, many conventional forces and some special operations units deployed to Baghram without tents. Consequently, several hundred tents had to be procured on short notice to provide adequate life support for these units.

Water Supply

Providing an adequate supply of potable water at Baghram was also challenging during its rapid expansion. Initially, bottled water was flown in, and this was sustainable when the camp consisted of fewer than 300 personnel. However, it soon became apparent that as the population expanded, bottled water would not be adequate to meet dining, laundry, and hygiene requirements.

During their occupation, the Soviets had built two wells at Baghram, but neither of the pumps was operational when U.S. forces secured the base. A British well-drilling team and U.S. engineers repaired or replaced the pumps. The British team tested the water from one well and confirmed that it was safe for drinking. However, reverse osmosis water purification units were brought in for both wells as added insurance of safe drinking water.

Repairing the well at Baghram required that engineers overcome a heavy lift problem. A crane was not available to lift the pipe from inside the well, so a helicopter secured the existing pipe and pulled it out. At Kandahar, wells also provided potable water. There, one of the pumps operated with three-phase electrical power. Very few people on the ground at the time had much experience with three-phase power. Fortunately, the engineer battalion S3, who had an electrical engineering degree, and a logistical assistance representative from the Tank-Automotive and Armaments Command were able to get the pump into operation. Had these people not been available, the pump would have had to be replaced with a pump that operated on more conventional single-phase power.

Latrine Facilities

The first latrine constructed at Baghram

The latrine facilities at Baghram went through several stages as the base camp expanded. The first latrine was a single privacy box constructed of four military metal pallets placed over an available sewage manhole cover (see photo above). The camp quickly outgrew this facility, and latrine facilities progressed to slit trenches and urine tubes. As these facilities were improved to provide for privacy, more construction materials and engineer assets were flown in or purchased locally. In a theater where the primary—and often the only—means of logistical support is by air, getting heavy engineer equipment and large stocks of materials into Baghram was challenging. Early on, delays were common and often frustrated engineer planners on the ground.

Units were not accustomed to providing their own latrines. A general consensus of senior participants in the operation was that unit-level field sanitation tasks need more emphasis during home station training exercises.

Because the area around the Baghram airfield was heavily mined and littered with unexploded ordnance (UXO), continually relocating slit trenches was not practical. As the base camp continued to expand, slit-trench latrine facilities progressed to burn-out latrines. Once these facilities were constructed, personnel hired from the local area maintained them. In the Baghram area, planners were fortunate that there was plenty of unskilled labor available and willing to maintain burn-out latrines.

At the end of February, porta-potties became available and started to replace the burn-out latrines. At Baghram, local contractors maintained the porta-potties, but finding competent contractors turned out to be somewhat challenging for engineer planners. The long-term goal of the camp at Baghram is to tap into existing sewage lines. However, the problems involved with locating and clearing existing lines may make it more feasible to construct a completely new sewage system.

At Kandahar, the latrines progressed in a similar manner. Porta-potties there were serviced by a Canadian team with the appropriate equipment. Waste was hauled to a local leach bed within the camp perimeter. It is noteworthy that burn-out latrines, as opposed to porta-potties, are generally considered the best interim solution since using contractors or coalition partners for waste disposal will not always be a readily available

An Aardvark flail used to clear the base camp area

option. As of this writing, a utilities detachment was installing a sewage main at Kandahar that will allow gray water to be drained directly to the leach bed and will allow some existing facilities to be brought into service. Fortunately, the engineer battalion commander purchased a commercial ditching machine for each of his companies before deploying. This equipment has proved very useful for installing cable, sewage lines, and underground power lines.

Shower Facilities

Shower facilities were quickly sought at Baghram as well as at Kandahar. A few permanent facilities were located and put into operation by the combat heavy engineers, but they were always overcrowded and were not nearly adequate for the number of soldiers at the camp. Many units did not deploy with kits or materials to make field-expedient showers, so they were dependent on the logistical system to provide them. Some of our coalition partners, however, came with field shower equipment and were able to provide service to their units. As of the writing of this article, showers were still in high demand at both base camps.

Power Distribution

Power generation went through similar development at both Kandahar and Baghram. Initially, units depended on their organic tactical generators for their power needs. At Kandahar, personnel from prime power units arrived and quickly designed power grids. The existing power distribution systems at both camps were deemed too unsafe or unreliable, so the utility detachment and other engineer personnel began installing underground power lines. The biggest constraint in getting the power grid into operation at both camps was the transport and availability of the prime power unit's large 750-kilowatt (kW) generators. Once these generators were on the ground, the prime power units—with the assistance of the utility detachments—installed a power grid in relatively short order.

The mission of the prime power units is to design the power grid and provide low-voltage (120/208 – 60 hertz) power to the user. Their normal tasks do not include running long exterior low-voltage lines to end users. Military occupational specialty 51R electricians assigned to the combat heavy engineer units were very competent at interior wiring tasks, but most of them had little experience with running long exterior low-voltage lines. Fortunately, soldiers from the prime power detachments were able to assist the combat heavy units' electricians, who installed low-voltage power lines for other units as required.

It was noted that the generation of technology used by the prime power detachments is based on aging technology. Prime power personnel are required to manually balance the loads placed on the power grid. In modern power grids, this task is automatically accomplished by semiconducting resistance circuit boards. In addition, the step-down transformers that they use can only be obtained through the Army supply system and are unlike the ones readily available off the shelf. This is potentially problematic, since the required transformers can only be procured from limited sources.

The initial assessment was that the power requirement at Kandahar was 2.2 megawatts. This required the base camp to use three 750-kW generators and one backup 750-kW generator. However, during the summer months, many units subsequently added environmental control units to provide air conditioning. These requirements were not initially accounted for, and they easily doubled the requirement for 750-kW generators from four to eight.

This situation points to a larger issue. The Army has not clearly defined the standards for base camps. Established standards or goals are needed so that future base camp infrastructure plans can be completed early on and ample lead time is available for necessary logistical support coordination. Without established planning standards, planners have nothing on which to base plans. To solve this problem, the Coalition Forces Land Component Command (CFLCC) C7 and Central Command (CENTCOM) staffs drafted—and received approval for—a set of standards that are available for future operations. These standards are called the *Sand Book.*

Base Camp C2 and Master Planning

During early stages of base camp development, planners sometimes found it difficult to expand the camp in an organized, synchronized manner. This was especially true at Baghram, and one of the ways this problem manifested itself was when planners discovered that a recently renovated building could not be used as a dining facility because of force protection concerns. This situation was partially attributed to the rapid and unpredictable growth of the base camp but can also be attributed to the rapidly changing C2 structures and missions of the forces at Baghram. A brief history of Baghram will illustrate how the base camp C2 structure evolved.

On 19 November 2001, CFLCC issued operations order (OPORD) 02-005, which directed CFLCC forces, in coordination with coalition forces, to operate and maintain Baghram airfield to support humanitarian assistance and set the conditions for follow-on operations. Task Force Baghram was officially activated on 29 November 2001. The initial staff consisted of 18 personnel. The task force's mission was to protect the force, conduct airfield and detainee operations, provide base support to seven coalition tenet units, and provide C2 to the approximately 600 coalition and joint forces operating in the Baghram Valley area. Key tasks also included enabling infrastructure development within Afghanistan.

On 9 December 2001, CFLCC published fragmentary order (FRAGO) 02 to CFLCC OPORD 02-005, which directed the movement of a colonel from CFLCC C3 (Rear) to assume command of Task Force Baghram. Over the next three months, the task force headquarters grew to nearly five times its initial staff strength, and tenant units grew to more than 4,000. As the number of tenant units and their corresponding life support requirements quickly increased, problems such as the one described in a preceding paragraph began to surface, and it became apparent that closer attention had to be given to base camp development.

A base camp planning board was established on 27 January 2002, based on the recommendation of a member of the CFLCC C7 staff who was sent to Baghram to assist in the orderly expansion of the camp. This colonel, the chief of construction and facilities section of the CFLCC C7, became the de facto mayor of Baghram and held this unofficial position for about seven weeks. The concept of the planning board and base camp mayor was taken from the C2 structures recommended by the *Redbook*, a planning guide for base camp development used in Europe. The planning board, which consisted of representatives from most of the major tenant units and staff elements, met weekly. The meetings provided a forum for representatives to voice requirements and issues. In addition, an officer who specialized in master planning deployed to Baghram on a temporary basis to help develop the overall infrastructure plan. The board developed a robust plan and successfully housed an additional 1,000 personnel during the last five days in February.

About this time, a seven-person facilities engineer team (FET), consisting of engineers with a variety of engineering disciplines, was deployed to Baghram. The team's mission was to assist the base camp planning board (which later became the Base Operations Center) in developing technical scopes of work and designs for future base camp infrastructure upgrades. The FET found that the Theater Construction Management System (TCMS) was useful for obtaining basic designs and drawings, even though some of the drawings were outdated. In addition, it found that the software was not user-friendly unless the user was thoroughly familiar with the program.

The *Redbook* was used in space allocation planning for services such as postal, base camp C2, laundry, and bathing. The FET found that having team members with basic surveying skills was useful for making field surveys of various sites. In addition, the team found that it would have been beneficial to have a power distribution engineer on the team. The team also coordinated with CFLCC C7 staff and the U.S. Army Corps of Engineers liaison officer to coordinate scope of work for projected military construction and Logistics Civil Augmentation Program projects.

The FET was given a general planning horizon and number of personnel to plan for when it began work in Baghram. Until that time, a clearly defined end state for the base camp was difficult to ascertain, which made it rather hard for engineer planners to commit the right resources to base camp planning and development. Understandably, security concerns over future operations to be staged out of Baghram were likely the reason why few on the ground knew how rapidly the camp would expand and how permanent the expansion would be.

Task Force Baghram commenced drawdown and transition activities on 21 February 2002, and on 6 March 2002 it officially transferred staff functions and responsibilities for garrison C2 responsibilities to the commander of the resident supply and service battalion.

A ditching machine used to install cable and sewage and power lines

Lessons Learned

Engineers and logistical planners learned the following lessons regarding base camp infrastructure development and C2 in Afghanistan:

Bed-Down Facilities

- Clearing areas of mines and UXO for tent space may limit the pace at which a base camp can expand in areas where the mine/UXO threat is high.
- Units should come prepared with enough tents to accommodate their personnel or should let their higher headquarters know their requirements early on.

Water Supply

- In austere theaters that are dependent on logistical support by air, using bottled water as the only source of potable water may not be sustainable.
- Combat heavy engineer units should know how to service wells and pumps, to include pulling and replacing pipes. They also should know the basics of three-phase power.
- Drilling new wells may be necessary if existing wells are not satisfactory or are not available.
- Units must be ingenious and use all available assets to accomplish their missions in austere environments.

Latrine Facilities

- Battalion-sized and smaller units should be prepared to provide for their own field latrines until more permanent facilities are constructed.
- Units may not be getting the necessary training on basic field sanitation tasks because of the dependence on portable latrines in most training areas and the relatively short duration and low density of troops during training events.
- Units that are not prepared to construct basic latrines place additional and unnecessary requirements on scarce engineer resources.
- Units must mark slit trenches and urine pits when they are filled in so that future base camp expansion can be planned without jeopardizing the health of the inhabitants.
- Porta-potties cannot always be expected to replace slit trenches since they are dependent on the availability of maintenance equipment in theater.
- A ditching machine allows utility detachments and engineers to rapidly install cable, sewage lines, and underground power lines.

Shower Facilities

- Units should deploy with materials to construct field showers and be prepared to use them until more permanent facilities are in place.

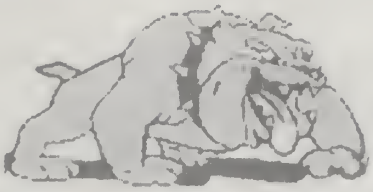
Power Distribution

- Availability and transport of 750-kW generators can be a limiting factor in the rapid establishment of a power distribution system. Off-loading the generators from the aircraft is difficult since each generator weighs more than 39,000 pounds and requires a special loader to off-load it. This special loader itself requires heavy lift assets to off-load from the aircraft. Although clearly stated in FM 5-422, *Engineer Prime Power Operations*, the logistical coordination required to transport these large generators into austere areas of operation should not be overlooked.
- Units should train on how to run low-voltage power lines to main access points provided by prime power units.
- Ditching machines greatly enhance the rate at which power lines can be installed.
- The technology used by prime power units should be upgraded to keep up with common industry standards.

Base Camp C2 and Master Planning

- It is difficult to plan for base camp facilities when the population rapidly and unexpectedly expands and the internal C2 organization rapidly changes.
- A Base Camp Planning Board should be established as soon as possible to assist with the organized development of the infrastructure of the base camp.
- The FET enhances the infrastructure planning for base camps.
- Allowing the FET to tailor itself to the specific mission enables the right capabilities to be deployed.
- Clearly defining the end state for a base camp is the single most important thing that can be done to ensure that proper planning for life support can be accomplished.
- The TCMS is generally useful but needs to be updated and made more user-friendly.
- The *Redbook* is generally useful but should be updated to include base camp living standards or goals for varying lengths of expected occupation in austere environments such as those encountered in Afghanistan. Some of these standards are addressed in the *Sand Book*. However, every commander should have his own standard.

Major McNulty is the executive officer of the 577th Engineer Battalion, 1st Engineer Brigade, Fort Leonard Wood, Missouri. Previous assignments include operations officer, 5th Engineer Battalion, Fort Leonard Wood, and commander, B Company, 299th Engineer Battalion and 43d Engineer Company, 3 ACR, Fort Carson, Colorado. A graduate of the United States Military Academy, MAJ McNulty holds a master's in mineral economics from the Colorado School of Mines. He traveled to Afghanistan as a member of a Combined-Arms Assessment Team led by the Center for Army Lessons Learned, Fort Leavenworth, Kansas.



Operation Bulldog Barrier

By First Lieutenant John Mooney

The wake of the 11 September 2001 attacks left much of the Army—including the forces stationed in Hawaii—scrambling to implement antiterrorism and force protection measures. Though measures such as identification card checks and vehicle searches were implemented immediately, there was still the threat of a brute-force attack, either via charging through the gates in a vehicle or by car bombing. United States Army Hawaii (USARHAW) has plastic water-fillable barriers to cover this threat. But, unfortunately, these barriers are limited in number, are intended to be temporary, and offer less protection than a solid concrete barrier.

At most posts, such a problem could be solved easily. Concrete highway or "New Jersey" barriers are common and would simply need to be purchased and moved into place at installation gates and mission-essential vulnerable areas (MEVAs). On the island of Oahu, finding concrete barriers is a little more difficult, and to ship such barriers from the mainland United States would be extremely expensive and slow. Bids from local civilian contractors were equally impractical, since they could produce only three to five barriers per day at an exorbitant cost. Recognizing the criticality of this need, the USARHAW commander turned to the 84th Engineer Battalion (Combat) (Heavy) at Schofield Barracks.

Photo courtesy of 2/25 Aviation

An aerial view of the jobsite

Mission

On 20 September, the 84th received the mission to construct at least 25 concrete barriers per day—for an indefinite period of time—with the following specifications:

- Must stop a vehicle traveling at 55 miles per hour
- Must be movable by a forklift and crane
- Must measure approximately 3' x 2' x 6'
- Can be painted yellow or beige, depending on use

Project Planning

The civil engineer section (S3C) began to develop a design for the barriers, and Bravo Company started planning the project, using FM 5-412, *Project Management*, as a guide. Because there was such a critical need for the barriers, we could not afford to delay the start of production. In this case, a 50 percent solution right away was better than a 90 percent solution too late. The indefinite nature of the project was the most significant factor in the planning process. Estimates for the total number of barriers needed ranged from 100 to 3,000. This meant that maximizing efficiency was paramount and that the plan could not ignore normal day-to-day activities such as physical training, maintenance, and personnel actions.

We determined that the most efficient method would be to develop an assembly line. By breaking down individual tasks to the most fundamental levels, soldiers could focus on a single task continuously, which would cut down on mistakes and increase production. The use of jigs or templates for these tasks would virtually eliminate mistakes. In addition, any soldier could learn any single operation on the assembly line very quickly, allowing supervisors to allocate any soldier to any task based on changing needs and opening the possibility of using other military occupational specialties to augment the Career Management Field 51 (general engineering) soldiers.

The battalion motor pool was selected as the site for the construction, due to its abundant

Soldiers remove a new barrier from its form.

space, vehicle access, existing electrical and plumbing utilities, and proximity to the rest of the battalion. Moreover, the platoons could work out of their motor pool storage sheds, and the tools and equipment would remain in a secure area throughout the project. This proved to be one of the wisest decisions made during this project.

Building the Barriers

In working out the details of the project, the process of building the barriers was separated into six major operations. Each of those tasks was further broken down using flow diagrams as outlined in FM 5-412, Chapter 4.

Fabricate cages. The design for the reinforcing steel (rebar) cages called for #4 (1/2-inch diameter) rebar to be cut, bent, and tied together into cages. There were four different types of pieces for the cage: two 5'4" x 1'8" braces, three 5'3" x 2'4" long stirrups, five 2'3" x 1'7" short stirrups, and two 4' lifting hooks. The processes to build each piece were broken down into the most basic steps: cut to length, bend, assemble, and tie. We determined that it would be more efficient to cut and bend the braces in two pieces, then weld them together. We also determined that for the sake of strength, the lifting hooks should be welded to the cage. Once the cages were completed, they were moved to a location where they could be conveniently placed in the concrete forms.

Construct forms. The woodworking processes were split into a dimensional lumber-cutting operation, a plywood-cutting operation, and a forms-assembly operation. The plywood was cut to be sheathing for the sides and bottom of the forms. Yokes were cut from 2" x 6" lumber, and 2" x 10" lumber was cut to leave holes for forklift tines. The precut lumber would be partially assembled at the woodworking station and moved out to the concrete placing area for final assembly. Once the forms were complete, high chairs would be attached to the rebar cages with zip ties and the cages placed in the forms.

Place concrete. The plan was to place the forms in long rows, leaving a lane between rows wide enough for a ready-mix concrete truck. Each row would correspond to one day of work. On any given day, we used one row for form assembly and the next for placing concrete. The third row would contain previously poured concrete that was curing, and the fourth row would contain forms that were ready for disassembly. The last row would be for painting the barriers. Finally, we anticipated that we should have at least two extra storage rows to allow the unit that picked up and delivered the barriers some flexibility in scheduling. To actually place the concrete, we planned to roll the trucks down the line of forms, filling each form. The screed, float, and finish crews would follow right behind the truck.

Remove forms. Following placement of the concrete, we planned for the barriers to cure at least 36 hours before removing the forms. During initial planning, we did not have a definite place to remove the forms. We anticipated that the best way to find the most efficient method was to allow the crew leaders to use the trial-and-error method. We anticipated that the plywood forms would be durable enough to use for four to five concrete placements, and we realized that to reuse the forms, we would have to carefully remove them. The forms would then be moved to another line to be reassembled and readied for another concrete placement.

Apply paint. As with form removal, we were unsure during initial planning about how to most efficiently paint the barriers. We did note, however, that paint sprayers would be much more efficient than rollers or brushes and that environmental compliance would be a concern.

Deliver barriers. Delivery of the barriers was also left unplanned, because we had received the mission to construct the barriers but had received no requirement or guidance to deliver them.

Assecessing the Risk

The company safety officer and NCO conducted a risk assessment for each operation and created a safety plan. Most of the safety measures were fairly standard, such as using ground guides to move vehicles around the jobsite and assigning a dedicated safety NCO. One of the most important outcomes of the risk assessment was the identification of necessary safety equipment that was not on hand. For example, although safety goggles are included with most of our organic sets, kits, and outfits, we did not have enough for every soldier in the company. Also, we anticipated a lot of wear and tear on the safety equipment on hand and planned to order additional stock of those items.

Jobsite Setup

Four days after receiving the mission, Bravo Company began setting up the jobsite. During this short phase of the project, the barrier construction plan continued to evolve. Though the company had done a good deal of planning, many issues had gone unresolved due to the urgent need to begin the project.

The rebar station came together as planned. The station crew built metal-cutting tables with stops to ensure that rebar cuts were made exactly. They also built tables with makeshift rebar benders and stations for crews to tie cages together. The company maintenance section set up a welding station with our welding trailer and contact truck surrounded by welding screens. The makeshift bending tables were an excellent improvisation but produced large-radius bends, making it difficult to assemble the rebar cages within tolerance. Fortunately, before setup was complete, the command provided funds to buy specialized, nonorganic tools, including dedicated rebar benders.

The woodworking stations and concrete lines came together quickly. The initial rows held 25 forms—the anticipated daily output. Based on estimates by the first sergeant and the commander, the row of forms would expand to 35, then to 50 before the first batch of barriers was completed. Also during the setup phase, we solved the painting problem. We bought paint sprayers using our tool fund and built a mobile paint booth from two M920 tractors with M870 trailers, plywood, and nylon matting.

On the last day before the start of production, the first sergeant and the platoon sergeants conducted a leaders' validation course for the NCOs to ensure that crew leaders knew how to supervise almost any station and to gain a rough production estimate. By 1 October, the first batch of barriers was ready for delivery.

Execution

Operation Bulldog Barrier, as it came to be known, went as planned for the most part. Over the 10-week period of construction, soldiers and NCOs on-site devised many improvements in efficiency. Without these innovations, Bravo Company might have been building barriers through January 2002. However, many problems surfaced during construction that significantly impacted production. Though many were out of our control, some occurred because of planning shortfalls.

The rebar operation turned out to be very manpower-intensive, requiring a minimum of 16 soldiers to run. Early in the project, before the process was streamlined, it took up to 30 personnel to maintain normal daily production. This was even more difficult when resources became a problem later on.

The woodworking operation was fairly simple once an initial batch of 150 forms was made. Since the forms were used four to five times before disposal, the next batch could be built over the course of several days, and we stockpiled extra form sections to replace those that broke or wore out early. The operation started slowly, although the purchase of a large table saw and a panel saw sped the process. Also, scrap plywood was used to build form inserts in the shape of—among other things—the 25th Infantry Division (Light) insignia.

The concrete placement crews consistently improved in efficiency. In the beginning, it took them seven to eight hours to place 50 barriers. By the end of the project, they could place 55 barriers in only four and one-half hours. Changes to the initial plan included running two ready-mix concrete trucks simultaneously and adding a fourth yoke to the forms, since about three forms would experience blowout failure each day. In addition, the customers began to request barriers that could hold soil for potted plants to make the barriers more aesthetically pleasing. These flowerpot barriers were much more difficult to construct.

It soon became apparent that form removal and reconstruction were critical to the project. In the first three to four weeks, the company worked 12 to 14 hours a day, and rebuilding forms was always the last to be completed. Initially, soldiers unscrewed the form completely and pried the sides off. Then, a forklift raised the barrier, and the bottom sheathing was removed. Lastly, soldiers used sledgehammers to remove the blocks that formed the forklift holes. This process was manpower-intensive and time-consuming, caused at least a dozen sledgehammers to break, removed the forklift from service elsewhere, and exhausted the soldiers.

One NCO came up with the idea to use the hydraulic excavator and a roller to lift the barrier and remove the forms. Also, the forms removal crew became proficient enough to remove only one side of the sheathing and then lift the barrier out of the form. With this system, the soldiers could remove and reconstruct 55 forms in seven to eight hours. Something

A soldier guides the vibratory roller forward. The slots underneath the barrier enable a forklift to carry it.

Two soldiers paint barriers in their M870-mounted mobile paint booth.

else that speeded up the process was that we discovered—by trial and error—that the forms could be removed as soon as 30 hours after placing the concrete.

By far, the most crucial aspect of the project was resources: when resources were delayed, we were delayed. Twice, we ran out of rebar because the contractor did not deliver the next batch on schedule. The same thing happened with tie wire, high chairs, plywood, and dimensional lumber. In addition, our cordless drills—which were critical to forms removal—burned out at a rate of about one or two each day, causing delays if they could not be replaced immediately.

The barriers were loaded and transported to their destinations around Oahu by the 325th Forward Support Battalion and the 25th Transportation Company (Medium Truck). The 65th Engineer Battalion and the 25th Infantry Division (Light) divisional engineer battalion directed the placement of each barrier.

By 14 December, Bravo Company had built 2,033 barriers at an approximate cost of $1.5 million. (Concrete costs about $170 per cubic yard on Oahu, and each barrier requires 1.4 cubic yards. Plywood is $34 per sheet.) The soldiers gained a lot of pride and an unprecedented level of esprit de corps. In addition, the efforts of the 84th Engineer Battalion saved USARHAW an estimated $5 million.

Lessons Learned

Resources drive the train. If any aspect of the project needs to be perfect, it is resources. A project should not be started unless you are confident that resources, especially materials, will be available when they are needed. In any project, resource needs should be projected well into the future.

Planning is an investment, and it does not stop when a project starts. In this project, we needed to begin as soon as possible. We conducted the minimum amount of planning necessary to start, then became focused on day-to-day operations. Foresight could have prevented the following problems:

- We neglected to plan a project tracking method, making it difficult now to estimate the project cost, equipment hours, and man-hours. We should have required platoon leaders to turn in daily or weekly reports on equipment, manpower, and material usage.
- Our safety staff deployed to Bosnia midway through the project. Because of the meticulous attention of first-line supervisors, we sustained only one reportable accident; however, the safety system on a project of this magnitude should be centralized.
- Tool control became difficult because there were so many tools on-site, and there was no plan to account for them on a daily basis. We should have established platoon-level toolroom procedures.
- We did not plan for waste disposal. We did not contract for trash bins until after scraps from the forms began to pile up on the jobsite. The waste generated by cleaning out the concrete trucks became a problem as well, and we had to improvise a solution to prevent a buildup of slag.

Fortunately, none of these problems were fatal, but planning ahead would have saved much time and effort, even after the project started.

The right tool is necessary for the right job. This project proved to Bravo Company that cordless tools are very valuable. Specialized tools that are not organic to a construction company are probably worth the cost. The savings of time and improvement in quality more than paid for our rebar benders and panel saw.

External resources maximize engineer effort. The 325th Forward Support Battalion loaded the barriers and moved them to gates and MEVAs, which relieved Bravo Company of that task. As a result, engineer soldiers could focus on the engineer mission, while transportation soldiers took care of the transportation duties.

Construction management doctrine should be trusted. FM 5-412 was extremely useful for this project. Many smaller projects allow the officer or NCO in charge to get away with minimal planning, but it is still a good idea to exercise critical-path-method planning and site layout/flow process analyses. The practice will reap huge benefits when trying to plan more substantial projects.

Conclusion

Overall, Operation Bulldog Barrier was a success. Barriers are now placed in dozens of areas around the island of Oahu, providing vital force protection to USARHAW. In addition, Bravo Company soldiers gained an immense amount of training benefit and unit pride, while at the same time saving USARHAW about $5 million.

First Lieutenant Mooney, now executive officer for Bravo Company, 84th Engineer Battalion (Combat) (Heavy), was previously platoon leader for 1st Platoon, Bravo Company. He holds a bachelor's in mechanical engineering from the United States Military Academy.

Leveraging the Power of the Regiment

By Lieutenant Colonel Christopher J. Toomey

Any valid description of the current and future operational environments demonstrates the continued relevance of engineers. We fully expect our forces to operate for extended periods in austere environments characterized by poor infrastructure and often saturated with mines. Consider recent operations in such diverse places as Haiti, Bosnia, Kosovo, and Afghanistan. Our forces operate amongst poor roads and immature and inadequate airfields, with little to no supporting utilities.

Add to this the potential for an elusive and asymmetric enemy that will necessitate extensive force protection measures—as well as the removal of varied, often undocumented minefields—and it is clear that engineers will be extremely busy. The record of recent operations bears this out. Regardless of the theater, whether removing mines along the Tuzla-to-Brcko rail line or preparing joint logistics-over-the-shore sites in Haiti, our engineers are key members of any combined-arms teams and are called on to execute varied missions that stretch our capabilities and challenge our leaders.

Yet, though we know the characteristics of any future environment literally cry out for engineers, force structure demands in the Stryker Brigade Combat Teams (SBCT) and the proposed Initial Division (IDIV) diminish the density of organic engineers. Figure 1 shows the SBCT Engineer Company. Optimized for the immediate tactical mobility of the SBCT, it is challenged to provide significant countermobility, survivability, or general engineering within its doctrinal 50- by 50-kilometer area of operations. Certainly, the embedded digital battle command will provide increased situational understanding that will help get the right engineer force to the right place at the right time, but an analysis of engineer capabilities versus potential requirements indicates that we are accepting considerable risk. Providing oversight over the engineer company and orchestrating maneuver support within the SBCT is the brigade engineer section, shown in Figure 2, page 14. The organic digital terrain team can provide terrain visualization down to brigade level.[1] Yet, the brigade engineer section is limited

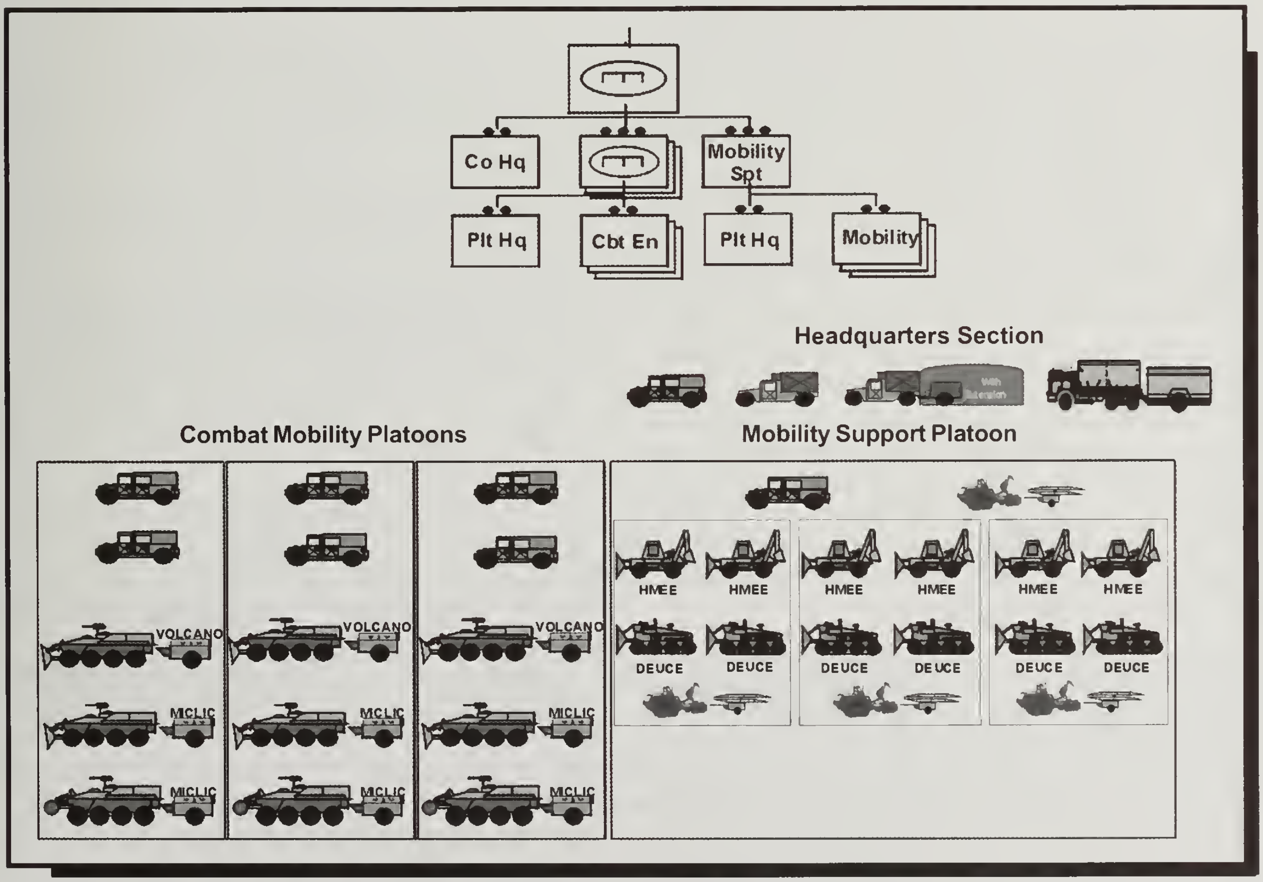


Figure 1. Organization of the SBCT Engineer Company

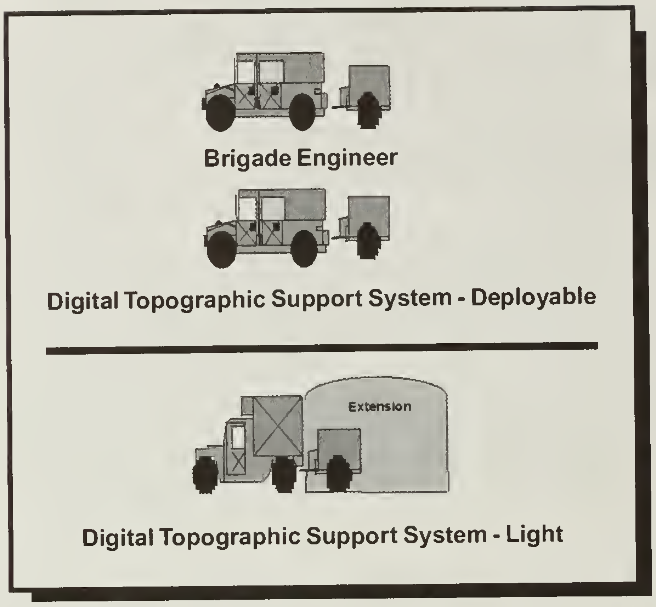

Brigade Engineer
Digital Topographic Support System - Deployable
Extension
Digital Topographic Support System - Light

Figure 2. The SBCT Brigade Engineer Section

in its connectivity and will have to fight for high-demand and scarce bandwidth. Additionally, it faces challenges when integrating analog-based legacy engineers into the fight.

In any operation, the SBCT engineers will require augmentation. As a Regiment, are we ready to provide that augmentation? Additionally, engineers "in the box" will want to leverage the full intellectual power of our Regiment to expand the combat power of our committed engineer forces. Are we ready to do this? I will explore both of these concepts in this article and provide some thoughts to add to an already active discussion on engineers within Transformation.

Building Effective Augmentation

Augmentation of organic engineers is expected. It is needed for anything but the most rudimentary missions, and the Regiment's ability to provide rapid and effective augmentation to the SBCT or IDIV will be a solid gauge of our effectiveness to the combined-arms team. As seen during Force XXI and with the SBCTs, augmentation of digital forces presents some unique challenges for analog legacy units. Since it is expected that the majority of nondivisional engineer units will be in the Legacy Force for some time, we need to examine the nuances of our Legacy Forces working with SBCTs and, eventually, IDIVs. Some of the obstacles are digital integration/awareness, establishing digital-analog integration procedures, and the challenges with austere logistics.

Digital Awareness

Engineer forces joining the SBCT are expected to be digitally aware and understand the full power of the Army Battle Command System (ABCS)[2]. A key component of the Interim Force is that it can deploy quickly. Rapidly augmenting engineers cannot expect a long train-up period to get soldiers and leaders ready to operate in the digital environment and must be prepared to operate either without the benefit of digital enablers or with digital equipment—and with luck some attached operators—loaned from the gaining unit. It is expected that they will know how to employ the equipment with minimal refresher training. This is especially true of leader understanding of digital battle command capabilities. At Fort Lewis, Washington, some units are finding that operators can normally be trained to use ABCS and digital command and control systems rather quickly—often, a few weeks is enough to learn how to push the buttons. Leader digital battle command employment training takes longer.

Familiarizing leaders, both NCOs and officers, is a training problem that can be addressed both at the institutional and unit levels. At the institutional level, we need to weigh adding digital training to already heavily committed training schedules. TRADOC recognizes the need for an Armywide digital training program, but it is currently not funded. The Regiment needs to carefully examine the overarching benefits of "leaping forward" to include digital training and awareness in its officer and NCO training.[3]

Fortunately, unit leaders do not need to wait to get started on familiarizing their subordinates with digital battle command and can consider incorporating ABCS familiarization into unit professional-development programs. Just because the system is not in the unit does not mean it cannot be trained. Those units fortunate enough to have access to actual systems via collocation with digital units must work to share some systems and develop digitally cognizant, if not enabled, leaders. Additionally, leaders should take advantage of the numerous digital distance learning tools that the Army is developing to support training digital staffs.[4]

Procedures

Leaders in both digital and supporting analog units must look to establishing the procedures and protocols for integrating an analog unit into a digital unit. Working within the digital environment will require some accommodations by analog units. They will need to understand what the digital units "see" and the workings of the digital units' information management methods—both inherent in the digital SOPs—to ensure that they have current information to achieve at least a measure of situational awareness.

A critical element is that nondigitized units will not "show up" on the digitized units' battlefield unless their locations are rigorously tracked and manually put into the system. Digital unit locations are routinely updated via the tactical internet. This will NOT happen with units that are not digitally enhanced with a blue feed tracking device. In a nonlinear battlefield, this can quickly result in fratricide and accountability problems as units operate and try to clear fires and effects in an environment with no front line. Thus, both supporting analog units and receiving digital units must have clear procedures to ensure that unit locations are known and disseminated.[5]

Austere Logistics

The mantra of "just-in-time logistics" within the Interim Force means bare-bones logistical infrastructure. With an anticipatory-based logistics concept that seeks to minimize on-hand inventory, Interim Forces will have a hard time absorbing resource-intensive augmentees, such as engineer units.[6] The anticipatory logistics concept is targeted at minimizing inventory, limiting the amount of on-hand supplies. This makes even more acute the continual problems associated with supporting echelons-above-division engineers within divisional and brigade areas, particularly during the early part of an operation.

One particularly challenging area is with maintenance. A look at the SBCT Engineer Company organization shows no dedicated engineer maintenance. In fact, the maintenance concept is focused around combat repair teams dedicated to the maneuver battalions and field artillery. There are only six military occupational specialty 62B construction equipment repairers in the entire SBCT, with four assigned to actual repair duties, one supervisor, and one technical inspector. There are serious challenges with even supporting the SBCT Engineer Company, never mind any augmenting forces.

Engineers must anticipate providing—or negotiating from supporting logistics units—a combat service support "slice" to provide for their immediate needs and establish the procedures—via either digital or analog means—for providing logistical reports.

Reaching Back

One way that Interim Forces are expected to enhance combat power is to use reach (also known as "reach back" or "reach operations") to leverage assets not under their immediate control. Though possessing a physical quality in terms of calling for additional assets and logistics, reach also has an arguably more powerful information-oriented quality (see Figure 3).

Engineer Reach

Engineers are already experienced with "reaching" to enhance the informational combat power of deployed forces. Indeed, such initiatives as field force engineering that are currently employed to support forces with U. S. Army Corps of Engineers-provided information are already making great strides in ensuring that engineer forces can tap into the intellectual power of the Regiment. Notwithstanding recent accomplish-ments, the Regiment needs to consider how to maximize its reach potential and continue to look for opportunities to both exercise and practice reach operations.

At an extreme fidelity, reach involves creating the conditions for "brilliant push," where the right information is pushed to the user at the right time and in the right format, vice "smart pull," which is someone answering a carefully worded question. One is proactive, while the other is reactive. One removes the burden of "asking the right question," while the other relies heavily on committed forces doing the asking.

The Regiment is already moving toward a smart pull. Using a wide range of mediums to include cell phones, deployed engineers are in contact with the Regiment, asking questions and getting answers. But is this enough? Are there missed opportunities because we are not formulating a brilliant push?

In establishing a push-oriented reach capability, the Regiment will have to commit to establishing some protocols on how to conduct business and manage information. Additionally, engineer forces in the field—at all echelons—need to establish the conditions to provide opportunities to train reach operations. Only rigorous training will expose problems with procedures, architectures, and connectivity.

Reach: The process of expanding the commander's information battlespace through networks to exploit agencies and assets both inside and outside of the theater—
Brilliant Push vs. Smart Pull!

- **Smaller deployed footprint**
- **Shorter deployment timeline**
- **Fewer air lifts required**

Figure 3. Moving toward a definition of reach

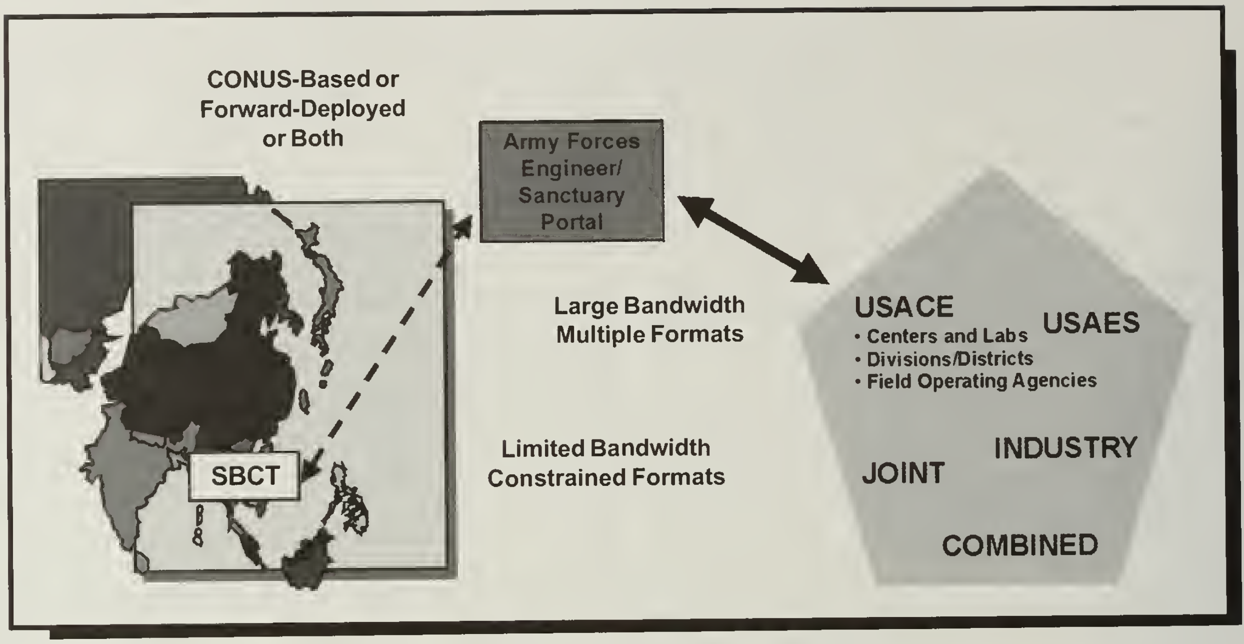

CONUS-Based or Forward-Deployed or Both
Army Forces Engineer/ Sanctuary Portal
SBCT
Large Bandwidth Multiple Formats
Limited Bandwidth Constrained Formats
USACE
• Centers and Labs
• Divisions/Districts
• Field Operating Agencies
USAES
INDUSTRY
JOINT
COMBINED

Figure 4. A notional example of engineer reach

Developing a knowledge agent, an organization that represents the informational interests of the committed engineer force, is a step in the right direction. A knowledge agent can serve several functions. First, it serves as a single, 24/7 information portal for the committed force. No more surfing around Web sites or hunting around agencies. Next, the knowledge agent is virtually linked to the committed forces and, with a clear understanding of the commander's intent and conditions in the field, is able to anticipate requirements and push the right information to the committed force at the right time. Third, the knowledge agent, because it is connected to the larger global information network, is able to continuously mine the community for information that may escape members of the committed force who are operating under "less-than-office-environment" conditions. It is expected that the knowledge agent connectivity is normally less constrained than that found in the committed force, particularly during the early stages when bandwidth constraints over satellite communications will be acute. Finally, the knowledge agent can ensure that information is phased in at the right time and in the right format to ensure it is usable. The knowledge agent is an information manager for the committed force (see Figure 4).

Conclusion

Army Transformation and the emergence of the Interim Force present unique challenges for our Regiment. Without question, we want to ensure that we are engaged at every level to solidify the relevance and role of Army engineers in making our Army successful. All units should look for opportunities to further develop their ability to serve alongside digital forces while the Regiment needs to address developing ways to optimize engineer-related information needed by committed engineer forces. Overcoming the challenges ahead will be exciting!

Lieutenant Colonel Toomey, currently attending the Naval War College, was recently chief, Battle Command and C4ISR, at the Fort Lewis Brigade Coordination Cell, Army Transformation Task Force. The former commander of the 14th Combat Engineer Battalion, LTC Toomey is a graduate of the United States Military Academy and the Massachusetts Institute of Technology.

Endnotes

[1] Major Anthony Wright, "Concept and Organization of the IBCT Engineer Company," *Engineer*, May 2001.

[2] An overview of the ABCS system-of-systems is at the TRADOC Program Integration Office-ABCS Web site: *http://www.leavenworth.army.mil/tpioabcs/overview/ABCSoverview.exe*

[3] Discussions at ENFORCE 2002 indicate that the U.S. Army Engineer School is already moving to incorporate digital training into the Officer Education System and Noncommissioned Officer Education System.

[4] Warrior-T has numerous products to assist with training digital staffs.Try *Training the Brigade Battlestaff* at *http://fioasat.hood.army.mil/docdetail.asp?docid=239.*

[5] Warrior-T has assembled tactics, techniques, and procedures (TTP) to assist in integrating digital and analog units. See *Mixed TTP Manual* at *http://fioasat.hood.army.mil/products.sp?view=type&type=2.*

[6] This problem of supporting echelons-above-brigade/echelons-above-division engineer units is not new. Several methods are discussed in "Supporting Nondivisional Engineer Forces" by Major Christopher Toomey, *Army Logistician*, March-April 1996.

Vigilant Warriors 2002 Army Transformation War Game

By Mr. James L. Allen, Mr. Edd Pyatt, and Lieutenant Colonel Mark H. Potter

The ongoing Army Transformation is arguably the single largest effort to change itself that the Army has ever undertaken. As such, it represents a tremendous investment of every type of resource. The goals of transformation are generally well understood across the Army. Less well understood, however, is the ongoing development work to support transformation planning. The Army Transformation War Game (ATWG) is a part of that development. This year's ATWG, called Vigilant Warriors 2002, was held at Carlisle Barracks, Pennsylvania. The exercise involved a significant portion of the Army's senior leaders, including the TRADOC commander and the Army Chief of Staff. Vigilant Warriors 2002 is a good example of how the Army is trying to think about the future defense of our nation.

◆

Back to the Future

The year is 2020 and we are at war. The United States is preparing to go into battle with an enemy unlike any it has faced before. Inferior to U.S. forces in many ways, the enemy plans to use technological sophistication it possesses in certain areas to create vulnerabilities in perceived U.S. strengths. The enemy's approach is to use the Objective Force's heavy reliance on sensors as a way to disrupt U.S. operations. From unmanned aerial vehicles (such as the "Global Hawk") and space-based sensors to unmanned and manned ground sensors, the enemy has determined that these sensors can be used against us if they are fed disinformation or are overwhelmed with information.

Simultaneously, the enemy will try to win small but highly publicized victories as our forces are deploying. Designed to turn the U.S. population against continued fighting, these enemy actions are not so much to gain victory over the overwhelmingly superior power of the United States as they are to prevent defeat of its own forces until the United States loses public support and withdraws. It's a sound strategy, one that has worked before—for General George Washington in the Revolutionary War.

◆

Within the contemporary operating environment just described, the ATWG was fought against a backdrop of tremendous and chaotic conflict. U.S. peacekeeping forces deployed to the fictitious Southeast Asia country of Sumesia, only to find the operational environment changing to a counterinsurgency operation against well-organized separatist extremists. In the Caspian Sea area, a major regional fight developed between the U.S. ally Azerbaijan and the fictitious aggressor nation of Anfar, assisted by Iran, over access to the region's large oil and natural gas reserves. Other potential trouble spots included Colombia, a newly unified Korea, and the Balkans. Overlaid upon this world scenario were terrorist bombings and cyber attacks aimed at disrupting U.S. transportation and financial institutions.

Vigilant Warriors 2002

Such was the world of Vigilant Warriors 2002. With approximately 500 military leaders from across the services participating—as well as civilians, former ambassadors, and retired military personnel—the purpose was to assess the capabilities of the Objective Force in a 2020 operating environment. Fought using a seminar format, a live Red Force, and a multitude of scenarios, the exercise included a significant focus on homeland security operations, with maneuver support forces (engineer, chemical, and military police) playing a critical role.

The area of homeland security—with its significant possibilities of successful attack against domestic targets of high political or national importance, military power projection airports and seaports of embarkation, or other lucrative targets—drew the focus of the maneuver support community. The threat of chemical, biological, radiological, nuclear, and high-yield explosives; cruise and ballistic missiles; and nuclear and/or chemical "dirty" bombs on U.S. soil—combined with the conduct of disinformation and misinformation/cyber attacks against U.S. financial, industrial, government, and business interests to disrupt capital flow and impact world energy markets—produced conditions requiring engineer, chemical, and military police support. These homeland security incidents were a critical aspect of the war game, stressing Army resources to their limits and identifying insights for Army leadership into transformation issues created by simultaneously fighting terrorism overseas and at home. The key headquarters for fighting the homeland security battle was the newly created (in 2002) Northern Command (NORTHCOM), with missions including the following:

- Provide chemical response units to civil authorities (chemical).
- Provide explosive ordnance disposal assets.
- Provide medical support assets.
- Provide force protection (engineer, chemical, and military police).
- Provide air defense assets.
- Provide general-purpose forces for physical security of designated ports (military police).
- Provide crisis management, consequence management, and deliberate planning to support civil authorities upon request (engineer, chemical, and military police).
- Conduct command and control with civil authorities and subordinate forces (engineer, chemical, and military police).
- Provide liaison officers to civil authorities (engineer, chemical, and military police).

Since this range of missions is very similar to that of the real NORTHCOM, it provided an excellent opportunity to exercise those missions against a backdrop of global conflict.

That global conflict came to a head as the deployed force in Sumesia (an Objective Force division, a Stryker Brigade Combat Team, and minimal maneuver support and maneuver sustainment forces) became embroiled in a revolution while performing a U.N.-mandated peace enforcement mission between government forces and those of the National Independence Movement (NIM). With the NIM forces in control of the majority of the population, terrain, and forces on the island of Sumatra, they were able to put U.S. forces in the quandary of having sufficient combat power to defeat the NIM forces but lacking key mobility enablers needed to rapidly and efficiently maneuver small combat formations throughout the width and breadth of the island. For example, without the joint transport rotorcraft or significant mobility assets, U.S. forces found themselves constrained by the limited road networks and hostile terrain comprised of mountains, jungle, and flood plains. Having information and intelligence dominance and the ability to capitalize on the information by aggressively pursuing and destroying massed NIM forces using non-line-of-site and other standoff technologies was compromised by a Red Force that truly understood the key concept of the Objective Force—to survive by rapidly maneuvering in a nonlinear, noncontiguous environment. This dilemma produced the opportunity for the war game participants to explore, in detail, aspects of the Objective Force as part of determining the best possible avenues for force and combat developments.

Similarly, major theater war erupted in the Caspian. The U.S. and allied forces quickly squelched an Iranian incursion, and the Iranian army was driven behind its borders. The Anfarians proved to be no match for the superior intelligence, combat power, and resolve of the friendly forces, and in a matter of days, it was all over. Engineer, military police, and other post-conflict forces were left to reconstruct a nation and handle the thousands of prisoners and displaced civilians.

The give and take of the war game in these missions produced the following key insights:

- There is a need to develop actionable intelligence for the homeland security mission area.
- Sensor technology can contribute significantly to homeland security.
- Liaison officers are needed among NORTHCOM, the 29 Federal Response Plan-led federal agencies, Canada, Mexico, and U.S. territories to maximize operational interconnectivity.
- Critical infrastructure protection requires an Army/civil authority partnership.

(continued on page 21)

Supporting Army Recruiting and Retention

By Ms. Zandra Smith, Captain Kristen Youngman, and Lieutenant Colonel Ronald N. Light

> *"Because recruiting is so critical to readiness, it is #1 on my mission-essential task list."*
> *General Eric K. Shinseki, Chief of Staff of the Army*
> *(Manning Message, 8 November 1999)*

The United States Army makes no secret that recruiting and retention of quality soldiers and officers are vitally important to its continued preeminence. The Honolulu District supports both of these crucial missions through its real estate services and intern programs. It is one of 18 U.S. Army Corps of Engineers districts (out of a total of 41) that supports the recruiting efforts of the Army and the other armed services. Throughout the Department of Defense, the Corps of Engineers supports nearly 6,800 recruiting and support facilities: Army (2,022), Navy (1,725), Air Force (1,587), and Marines (1,465).

The Honolulu District is engaged throughout the Pacific Region in support of the Honolulu Company of the U.S. Army's Portland, Oregon, Recruiting Battalion. Geographically, the District's area of responsibility is the largest in the Corps. Its support begins in the Hawaiian Islands, then moves 2,400 miles south to the territory of American Samoa, west 3,800 miles to the territory of Guam and the commonwealth of the Northern Marianna Islands, and on to Japan and Korea, nearly 5,000 miles from Hawaii.

In the Honolulu District's area of operations, there are 13 Army and 21 Navy, Air Force, Marine Corps, and Army National Guard recruiting stations. For all these offices, the District executes all office space leases, building upgrades, telecommunications support, furniture purchases, and emergency repairs.

The Honolulu Recruiting Company was recently honored as the top producer of recruits in the western United States. The NCO in charge of the Kapiolani, Honolulu, station attributes part of the company's success to the support he gets from the District. He noted that in today's competitive job market, a professional-looking recruiting facility sets the right tone for prospective recruits. The office there is large, clean, and well-lit and meets the mission requirements. If there is a problem with lighting, building fixtures, or janitorial service, he calls the Corps, and it provides excellent, timely service.

I AM AN ARMY OF ONE
RECRUITING
U.S.

Photo by Michelle Cain

The Honolulu District assists recruiters for the Army and other services across the Pacific region through leases, building upgrades, telecommunications, furniture purchases, and emergency repair support.

In FY01, the Army recruited nearly 1,600 Pacific Islanders into the U.S. Army or Army Reserve. Recruits came not only from Hawaii, Guam, the Northern Marianna Islands, and American Samoa but also from the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau. Residents of Micronesia, Palau, and the Marshall Islands are able to volunteer for

A recent Honolulu District intern checks work on the Palau Compact Road project with the District's Palau Resident Office project engineer. The District is overseeing construction of the U.S. Department of the Interior's 53-mile road project.

Photo by Doug MaKitten

service in the armed forces of the United States through an agreement called the Compact of Free Association, signed in January 1986.

While the Honolulu District executes a relatively small portion of the Army's $172 million recruiting facility program for FY02, its support to Army recruiting efforts is important. First, it provides access to the military services for Pacific Islanders. This helps to ensure diversity of the force from this vital part of the world. Second, the District's service supports the United States' strategic engagement of the region, providing a link to the Department of Defense's growing reliance on the Pacific area.

Recruiting quality soldiers and officers is important and retaining them is a must. In recent years, the Army faced a particular problem regarding the loss of company grade officers. Accordingly, throughout the Army, emphasis was on studying the problem and finding ways to solve it. Analysis determined that young officers would be more likely to continue serving if they were more aware of the variety of career options the Army offered. In response, Corps districts—including Honolulu, Alaska, Charleston, Far East, Fort Worth, Mobile, Portland, Savannah, Seattle, and Walla Walla—implemented officer intern programs. (See article, "The Junior Officer District Intern Program," *Engineer*, October 2000.)

The Honolulu District's intern program began in August 2000 through memoranda of agreement with tactical engineer units located in Hawaii. The intent of the program is to expose Army officers and cadets to the Corps of Engineers from the perspective of a field district, alerting them to the many opportunities to serve in the "nontactical" side of the Corps. The program invests in junior officers, relying on the mentoring, coaching, and teaching of Department of the Army civilians in the District.

The typical internship lasts three weeks and enables company grade officers and cadets to learn about work the District performs at any one of four resident offices throughout the Pacific. This includes the Palau Compact Road Resident Office, Republic of Palau; Kwajalein Resident Office, Kwajalein Atoll, Republic of the Marshall Islands; and the Schofield Barracks and Fort Shafter Resident Offices, located on the island of Oahu, Hawaii.

This professional development opportunity encourages officers and cadets to appreciate the diversity and opportunities to serve in the Corps. Participants gain a greater understanding of the functions and roles of the Corps, the support provided to major commands and installations, the complexities of construction management in the field, and the opportunities to serve within the Corps.

One of the first participants in the Honolulu District's intern program said that previously she saw the Corps of Engineers as a federal government organization that invested in the local community through its civil works construction projects. But the intern program helped her realize that the Corps's mission is much greater, especially in the area of impacting soldiers' lives on a daily basis. The new barracks and family housing construction in Hawaii, workplace renovations, and other facility construction demonstrated to her how the Corps serves the Army and soldiers as part of the "One Team" concept.

An important facet of the District's program is the opportunity for officers and cadets to interact and learn from Department of the Army civilians. According to the chief of the construction branch—a former Army engineer officer—participants learn the life cycle process of a construction project from its inception, through design, and into construction. The officers and cadets work closely with seasoned professionals, who share their knowledge, life experience, and lessons learned over the years. The insights and techniques that the officers and cadets take away from the program apply to both tactical and nontactical situations. In addition, participating in the program establishes relationships and lines of communication to solicit counsel and advice in the future.

Investigating design difficulties, inspecting quality control, and scoping project requirements are a few of the tasks visiting officers tackle during their internships, which are structured to their interests. The officers are exposed to all the details of delivering a project, including project management, contracting, and safety. The intent is to get the officers out into the field, working with contractors, construction representatives, and field engineers. It's a hands-on program. Exposure to the civilian side of the Army and the Corps can be invaluable. Interns are surrounded by the projects these people construct and manage, and they bring a lot of management and construction expertise to the Army.

Since the program began, the 84th Engineer Battalion at Schofield Barracks has sent five officers to the Honolulu District for the three-week internship, one per month on average. Upon completion of the internship, every officer shares lessons learned and personal observations, and it has had a positive impact on junior officer retention in the 84th. To date, not one officer within the entire unit has resigned from active duty, and many are asking how they can get into a Corps district following successful completion of company command.

Every officer intern leaves with a much greater understanding of the Corps and the dedication of Department of the Army civilians who support the Army and the nation. Moreover, they leave excited and eager to be part of the Army in the future.

Ms. Smith is a Department of the Army civilian real estate specialist for the Honolulu District.

Captain Youngman completed an internship with the District while she commanded the 70th Engineer Company, 29th Engineer Battalion (Topo). She is currently training for an assignment in the 96th Civil Affairs Battalion, Fort Bragg, North Carolina.

Lieutenant Colonel Light was commander and district engineer of the Honolulu District at the time this article was written.

("Vigilant Warriors 2002" continued from page 18)

- Mobilization adversely impacts civilian first responder capability, because a disproportionately large number of first responders are also members of the National Guard and Army Reserve.
- There is a need for prioritized mission requirements to facilitate preparation by the U.S. military for homeland security roles and responsibilities.
- While the true ramifications of employing the Sumesian forces in a traditional combat role—as opposed to the nonlinear, noncontiguous role it was designed for—were never evaluated, it was apparent that this force must have all the enablers (such as command,control,communications, computers, intelligence, surveillance, and reconnaissance [C4ISR] and joint tactical radios [JTRs]) the design calls for, or there is serious risk associated with a conventional employment.

Conclusion

The ATWG was just one small part of the overall effort to determine the best possible implementation of Army Transformation. But even so, it represented a lot of hard work by a lot of leaders trying to see into the future. Their efforts to see as clearly as possible will have a long-term impact on how the engineer, chemical, and military police forces within our Army develop.

Mr. Allen is the lead analyst and science advisor for the Concepts Branch, Engineer Division, Maneuver Support Center (MANSCEN) Directorate of Combat Developments (DCD), Fort Leonard Wood, Missouri. He retired from the U.S. Army Reserve as a lieutenant colonel and has 34 years of active, reserve, and civilian military duty. Mr. Allen served in the 4th Infantry Division in Vietnam and the 1st Infantry Division in Germany.

Mr. Pyatt is a military research analyst with the MANSCEN DCD, Military Police Division. He retired from active military service as an aviation lieutenant colonel and has been involved in military police transformation since the move of the Military Police School to Fort Leonard Wood.

Lieutenant Colonel Potter is the total force integrator (AR) for the Engineer Division, MANSCEN DCD. During the three years in this position, he has been deeply involved in Army Transformation. Before his assignment to DCD, LTC Potter served as the plans chief and operations officer at both the 412th and 416th ENCOMs and 3d U.S. Army/U.S. Army Central Command.

V Corps Terrain Analysis Supports a Warfighter Exercise

By Lieutenant Colonel David R. Goddard

Effective terrain analysis pays big dividends to the warfighter. And during V Corps's warfighter exercise, Urgent Victory 2002, effective integration of terrain analysis in the military decision-making process contributed significantly to the success of the entire exercise. With the support of the 1st Armored Division and 35th Infantry Division, V Corps conducted Urgent Victory 2002 from 27 March through 2 April at Grafenwoehr Training Area, Germany. United States Army Europe (USAREUR) and 7th Army provided an exercise response cell to simulate the higher command headquarters. In each of these commands, the topographic units provided significant support to their respective higher headquarters.

The 320th Engineer Company (Topographic) provides V Corps's organic terrain analysis support. The 320th maintains a 22-person terrain analysis section, collocated with V Corps headquarters, on Campbell Barracks in Heidelberg, Germany. The remainder of the company is stationed at Grossauheim, Germany.

Important Early Decision

To ensure that the Corps Battle Simulation (CBS) gaming process was transparent and that the Corps gained the maximum training value from the exercise, the V Corps commander directed that the battle staff base its planning focus only on the *real-world terrain*. Commands can choose to fight only the simulated CBS terrain. (See article titled "BCTP Terrain Analysis: Unlocking the Mystery," *Engineer*, August 2001.) The commander's commitment to training the "right way" drove the military decision-making process and reinforced the vital role of the Corps's organic terrain analysis/topographic personnel.

Getting the Terrain Data

In preparation for the exercise, the terrain analysis technician began developing a terrain database for the exercise in November 2001. The National Imagery and Mapping Agency (NIMA) provided foundation data (FD), interim terrain data (ITD), vector interim terrain data (VITD), vector maps (VMAPs), and digital feature analysis data (DFAD) for the exercise area. NIMA generally produces FD to support planning products produced at a scale of 1:250,000. The Corps headquarters required planning products at a scale of 1:50,000, so the terrain platoon added more detail to NIMA's FD and other vector data.

With the assistance and cooperation of the Corps's G2 collection management section, the terrain platoon obtained imagery of the area from national sources. This imagery was analyzed and used to develop additional information about the area of operations. Features such as road networks, bridges, and airfields were added to the FD to create a Tactical Geospatial Data Set (TGDS) for the exercise. By the time the Battle Command Training Program (BCTP) seminar arrived, the terrain platoon was able to come up with about a 70 percent complete TGDS.

The TGDS was sufficient to facilitate the military decision-making process during the BCTP seminar. The seminar was held in Heidelberg, so as specific areas of interest and operations were refined, the terrain platoon could focus its production efforts on these areas. The platoon developed specific data for the road network leading to the river-crossing site, the crossing site itself, and the road network leading to follow-on objectives. Other products included—

- An elevation study used by the signal unit to locate line-of-sight communication assets.
- Vertical obstruction maps used by aviation units during flight planning.
- Determinations as to whether or not existing airfields could support military requirements.

Following the seminar and leading up to the train-up exercise, called Victory Focus 2002, the terrain analysis platoon continued to refine the TGDS and fill the information gaps that existed. Again, the Corps's collection management section worked closely with the terrain platoon to secure full-frame national imagery, which was used to develop Controlled Imagery Base–1 Meter (CIB01).

During the train-up exercise, mobility of the force was a key issue in enabling the Corps to move quickly to the river-crossing area and then continue the movement to follow-on objectives. The terrain platoon's efforts contributed significantly to the Corps's ability to maintain freedom of movement and enjoy great success. Within the exercise, the contribution of the divisional terrain teams was particularly evident during the river-crossing operation.

The 1st Armored Division terrain team developed the detailed terrain analysis products required to support the Corps's crossing of the river. The divisional team added another layer of detail and accuracy to the TGDS provided by the Corps's terrain team. This layer of detail facilitated the planning of river-crossing operations at the battalion level within the division. As the data was created, the divisional terrain team passed this data back to the Corps's terrain platoon as well, which allowed the platoon to update the Corps's master database and share the data with subordinate elements.

The Corps and division staffs continued to develop contingency plans, branches, and sequels throughout the exercise, which drove abbreviated military decision-making processes within the train-up exercise itself. Often, this involved developing terrain data for specific areas that had not been analyzed by the terrain platoon or teams. The terrain data developed in conjunction with this effort was also added to the master database and then disseminated to other subordinate elements.

A vital aspect of the support the terrain platoon provided to the Corps was identifying locations where the long-range surveillance teams could make the maximum contribution to the Corps's operations. The terrain platoon performed line-of-sight analysis to determine the best observation locations and helped identify suitable insertion and extraction locations. Again, this information was added to the Corps's master database.

By the end of the exercise, the Corps had significantly improved the quality of its master terrain database. The terrain platoon leader estimated that the database was about 90 percent complete and was nearing a 100 percent solution.

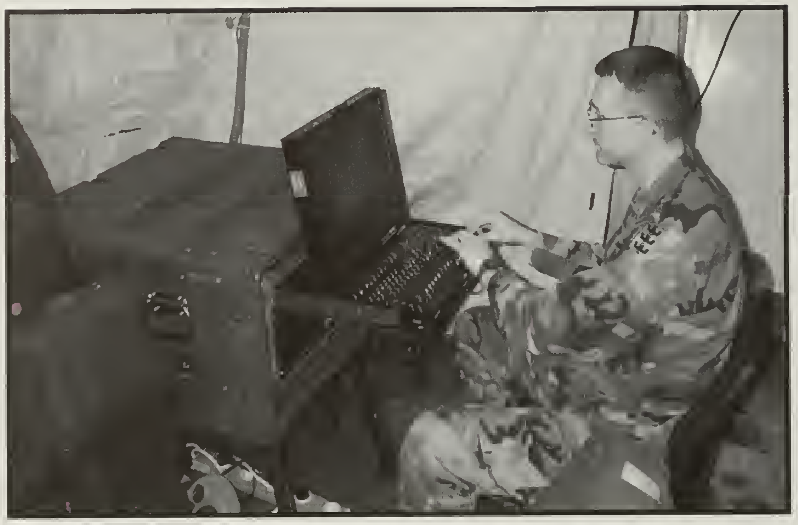
Significant Results

Several after-action issues were identified during the train-up exercise, including Strike tactical operations center (TOC) staffing, use of SkyMedia systems, function/role of the geospatial information and services (GIS) officer during the exercise, and dissemination of products.

New TOC Configuration

At the start of the train-up exercise, a full-blown Corps TOC was established. In this configuration, three of four squads of the terrain platoon, 320th Engineer Company, collocated with the Corps Main to provide the required topographic support. During the course of the exercise, the Corps tested a TOC configuration (called the Strike TOC), with a much smaller footprint. In this configuration, the terrain analysis platoon

The V Corps terrain team analyzes terrain data.



A soldier updates the terrain database during V Corps's warfighter exercise.

collocated with the 320th Engineer Company, leaving only three terrain analysts behind to support the Corps. However, these three personnel were insufficient to provide the required level of support and responsiveness to the Corps headquarters. During Urgent Victory 2002, the Strike TOC was staffed with about eight personnel on each shift. This allowed the terrain platoon to provide superior service to the Corps staff, while minimizing its footprint. This result confirmed that the minimum size of a terrain team should be about eight (squad size).

Satellite Connectivity

The Corps has two SkyMedia systems; however, both systems are nondeployable, and they provide little additional value to the Corps's forward-deployed topographic effort. In garrison, there are easier and more dependable alternatives for downloading commercial imagery and other geospatial intelligence, whereas in the field, the alternatives are limited. Since the terrain platoon doesn't have a deployable SkyMedia system, it is forced to rely primarily on the intelligence backbone to download data from outside the command. Due to the sheer size of commercial imagery and geospatial data files, an independent, deployable means of data transfer within the Corps's topographic company is required in the organization capabilities.

Dedicated GIS Officer

The Corps's GIS officer was dual-hatted as a targeting officer during the train-up. Since the targeting officer duties consumed a significant portion of his time during the train-up, he couldn't dedicate much time to his GIS duties. As a result, there was no one actively seeking out GIS requirements from other staff sections and subordinate units. During Urgent Victory 2002, the GIS officer was able to dedicate only slightly more time to his geospatial responsibilities, with the majority of his time being consumed by targeting. The role of the GIS officer is important. It should not be diluted with additional duties or dual-hatting. Corps and division engineers must insist on properly supporting this mission.

Geospatial Information Sharing

The bandwidth to provide digital availability of all the different topographic and terrain analysis maps does not exist within the Corps today. To ensure that the widest number of the Corps's subordinate elements benefit from the work of the terrain analysts, the 320th Engineer Company uses high-volume plotters to make hard copies of the various products and disseminates them to supported units. These copies are produced in the company's garrison facilities. During Urgent Victory 2002, the 320th was able to not only sustain this capability but also improve its responsiveness by deploying the high-volume printers to the field. This greatly improved the company's ability to provide support, especially to major units subordinate to the Corps. Mine maps and other products were produced and distributed to soldiers in the field. This capability was vital to supporting muddy-boot soldiers during the exercise.

Commander's Guide

Between the train-up and Urgent Victory 2002, the 320th Engineer Company published the *Commander's Guide to Topographic Operations*. The guide highlighted the products that the topographic company could produce and how these products could be used by various units to support the decision-making process. The guides, which were disseminated before and during the exercise, helped educate commanders on the capabilities of the topographic company and increased the demand for various products the company produced.

Command and Control Systems

An important observation made in both the train-up exercise and Urgent Victory 2002 was the limited ability to share digital terrain data with the digital command and control (C2) systems. There are several problems related to this issue including the use of different C2 systems within USAREUR and V Corps, the use of commercial off-the-shelf terrain analysis software, and the multitude of file formats.

C2 From Corps to Higher

The Global Command and Control System – Army (GCCS-A) only allows raster graphic backgrounds. These formats don't lend themselves to provide even the most basic of analysis capability or flexibility in displaying data. Most commanders demand more sophisticated products than this system is able to provide, so the staff is driven to use alternative software products to track the battle and provide a common operating picture (COP). GCCS-A functionality must be expanded to account for this more sophisticated need.

Experimental Freebies

The USAREUR staff relies heavily on FalconView™ as its primary utility for displaying the COP. V Corps, on the other hand, uses a Command and Control Personal Computer (C2PC) to display the COP and report the disposition of the force to USAREUR. Both the USAREUR and V Corps headquarters staffs prepare operations graphics with their respective C2 systems. However, the graphics can't be shared between the systems without manually converting them since the file formats for FalconView and C2PC are incompatible—as are the file formats being used by our terrain analysts. Corps and division headquarters should use the same C2 system or at least use compatible file formats.

Digital Topographic Support System

Our terrain analysts use Army standard commercial off-the-shelf software programs like Environmental Systems Research Institute (ESRI™), ArcGIS™, and Earth Resources Data Analysis System (ERDAS®) IMAGINE to analyze, develop, and improve the level of detail found on national-level products. These programs have more capabilities than C2PC or FalconView and allow the production of more sophisticated terrain products. Unfortunately, neither ESRI, ArcGIS, nor ERDAS will store information in a file format that can be read by C2PC or FalconView.

Labor-Intensive Work Around

During the final preparation for Urgent Victory 2002, the 60th Engineer Detachment commander manually converted V Corps maneuver graphics to ERDAS IMAGINE formats so he could georeference them. Then he manually converted this georeferenced information to FalconView formats. Through a rather inefficient process, he was able to ensure that both USAREUR and V Corps shared at least one aspect of the COP. During the exercise, the 54th Engineer Battalion employed a rather interesting work around for this problem. First, graphics from one program were projected onto a white board. Using a white-board marker, the graphics were traced onto the board itself. The map graphics from the other system were then projected over the graphics on the white board. Finally, the graphics were redrawn using the mouse to trace over the white board. But the difficulty in sharing databases is not limited to player units; it extends to the simulation cell as well.

Back to the Early Decision

The terrain database in CBS does not take advantage of the detailed terrain analysis performed by our units. The database it uses is rather rudimentary by comparison. It can be altered to more realistically reflect real-world conditions, but it would be better if our CBS database used the very detailed database prepared by the terrain teams. This would be especially true if the system were used for war gaming variations of a tactical plan. Sharing a common geospatial database between the various systems would improve the accuracy and validity of the conflict modeling process (war gaming) and the COP—used to manage conflict. The V Corps commander's commitment to train right pays off because the staff is well-trained, issues such as bandwidth and C2 compatibility are uncovered, and the following significant conclusions are generated.

Unify Terrain Data

An effort should be made to synchronize the development of tactical terrain analysis systems, tactical C2 systems, and simulation systems. This effort would eventually lead to a convergence of the geospatial databases supporting each of these systems.

Fix the USAREUR C2 Tangle

In the meantime, both USAREUR and V Corps should possess comparable and interoperable C2 capabilities. Compatible systems will improve the ability to transport, portray, and manipulate information that provides real-time visualization, collaborative planning, and decision tools in current and future network-centric operations. The file formats supported by commercial off-the-shelf terrain analysis programs used by the terrain teams must also support the C2 systems used within the command.

During Urgent Victory 2002, the V Corps terrain platoon was again reminded of the need for precision when making requests for information. The analysis and control element generally provides what you request. If you don't request the right product, it causes delays and additional work. An approach recommended by personnel at the U.S. Army Engineer School is to staff the analysis and control element with an engineer officer on a full-time basis. This would be of great value to the terrain analysis effort and the broader engineer effort as well.

Terrain Teams Worth Their Weight

The Corps's terrain team performed well during Urgent Victory 2002. The TGDS produced by the Corps and divisional terrain teams contributed decisively to the decision-making process during every phase of the operation—from the BCTP seminar through the exercise. In addition, the printed products produced by the 320th Engineer Company demonstrated its ability to provide timely, relevant, and useful products to support actual combat operations on the ground. The topographic soldiers, noncommissioned officers, and officers truly fulfilled their commander's charge by training the right way.

Lieutenant Colonel Goddard was chief of the GI&S Division, Deputy Chief of Staff for Engineers, USAREUR, at the time this article was written. He is currently serving as deputy resource manager, V Corps. Previous assignments include deputy district commander, Honolulu Engineer District; S3, 65th Engineer Battalion, Schofield Barracks, Hawaii; area commander, Honduras and El Salvador Mobile Engineer District; engineer team chief, Readiness Group Salt Lake; commander, 50th Engineer Company, Korea; commander, B Company, 4th Engineer Battalion, Fort Carson, Colorado; company executive officer and platoon leader, 54th Engineer Battalion, Germany.

Engineer Safety

Engineer Branch Accident Analysis

By Mr. Fred Fanning and Ms. Vicki Hall

Each year, Army personnel are involved in accidents, many of which could have been prevented. The key to preventing these accidents is for everyone to understand where they occur and learn how to prevent them or lessen their effect on us. The U.S. Army Safety Center at Fort Rucker, Alabama, maintains a database of Army accidents. Each time an accident occurs, a report is submitted through the installation's safety office to the U.S. Army Safety Center and then into its database, which any soldier or civilian employee can access by going to *http://www.rmis.army.mil.* In this article, we provide a quick analysis of accident statistics for the Engineer Branch over a three-year period—fiscal year (FY) 99, FY00, and FY01—in five accident categories.

Background

The nature of engineering tasks makes them among the most hazardous in the Army. Specialized heavy equipment use, quarry and blasting operations, construction, high-voltage-line maintenance, demolitions, diving, fire fighting, and earthmoving each has its hazards.

There are many types of accidents (see Army Regulation 385-40, *Accident Reporting and Records*), but the five most common types for engineer units are Army motor vehicle, Army combat vehicle, other Army motor vehicle (O-AMV), privately owned vehicle (POV), and personal injury-other. Army accidents are also classified by their severity—designated as classes A through E. An accident falls into a particular class if it has any or all of the criteria. Our discussion focuses on classes A through C (see Table 1).

Class A—Property damage is $1,000,000 or more; an injury or occupational illness results in a fatality or permanent total disability.

Class B—Property damage is $200,000 or more but less than $1,000,000; an injury or occupational illness results in permanent partial disability; five or more personnel are hospitalized as inpatients as a result of a single accident.

Class C—Property damage is $10,000 or more but less than $200,000; a nonfatal injury causes lost time from work, other than on the shift on which the accident occurred; a nonfatal occupational illness causes lost time from work or disability at any time.

Table 1. Army accident classes

Accident Analysis

Army Engineer Branch accidents have cost more than $14 million since FY99. About $12 million of that was for personnel injury and fatality costs. During that period, 40 engineer soldiers lost their lives and more than 400 were injured. Some of those injured received permanent disabling injuries that will involve treatment costs for many years.

Army motor-vehicle accidents involve tactical Army wheeled vehicles. The number of this type of accident has remained fairly constant from FY99 through FY01 (see Table 2). The causes are inattention, inexperience, excessive speed, and failure to take appropriate actions for environmental conditions. The average age of drivers involved in these accidents was 18 to 25. This indicates that perhaps the required level of operator experience should be raised to a higher standard.

Army combat-vehicle accidents involve vehicles such as armored personnel carriers. These accidents have also remained constant over the last three years (see Table 2). Causes point to improper or inadequate training for operators and improper maintenance, mainly during the preventive maintenance checks and services (PMCS) process. One area of concern is that improper maintenance on the track on the M113 has led to the tracks breaking and causing rollovers. Many of these rollovers have resulted in the death of the track commander.

O-AMV accidents involve operating an Army vehicle other than Army motor vehicles or combat vehicles, such as bulldozers, forklifts, road graders, rollers, and most other construction equipment. A major cause of accidents is that drivers lose sight of other vehicles or personnel because of

Accident Type A-C	FY99	FY00	FY01	Total
Army motor vehicles	18	13	15	46
Army combat vehicles	8	7	7	22
Other Army motor vehicles	11	12	10	33
Privately-owned vehicles	35	34	27	96
Personal injury—other	94	69	82	245
- Explosives	2	1	3	6
- Fire	2	1	1	4
Total accidents	166	135	141	442

Table 2. Three-year accident-type comparison for A-C accident classes

sudden or unexpected changes in the terrain. Maneuvering in the safe zone—that area in which the driver can see objects or other vehicles—is not specifically addressed during initial training but is only learned while operating the vehicle. It is important for engineer equipment operators to recognize that equipment and vehicles come with their own peculiar restrictions, and they must consider those restrictions before conducting a mission. Nothing should be assumed when it comes to operator capability. Supervisiors should perform periodic tests to ensure that proficiency is being maintained and standards are adhered to. We must never allow deviations from the standard to become the standard.

Are soldiers being properly prepared for driving and performing other aspects of engineering? No amount of classroom instruction, reference materials, or lecturing can replace the hands-on training needed to adequately understand a vehicle's abilities and limitations. For example, we have determined that blind spots on the M9 ACE are in excess of 75 feet. Yet, until recently, this fact was barely addressed in training materials. Now, lesson plans have been changed, and the issue is being taught to all new drivers.

POV accidents involve an individual operating a personal vehicle in an unofficial capacity. These accidents claim more lives of engineer soldiers than any other type of accident. Even though POV accidents in FY01 were down 21 percent from FY00 (see Table 2), 27 accidents is still a high amount. Investigations show that driver fatigue, inattention, distracted driving, failure to maintain control of the vehicle, and excessive speed are the top reasons for these accidents—the same reasons as for Army motor-vehicle accidents. Another parallel between these two types of accidents is the age of the operators, 18 to 25 years, indicating that the level of experience and maturity are contributing factors.

Personal injury–other accidents are those that involve injury to Army personnel not covered by any other accident type. These accidents include slips, trips, and falls; sports injuries; being struck by an object other than a vehicle; or injury by a tool. These accidents are common and can result in a wide range of injuries, from lost time to death. The causes of these accidents are normally failure to follow procedures, using the wrong tool, using a tool improperly, housekeeping hazards such as tripping, and improper use of pyrotechnics and explosives. It is critical that supervisors know the proper procedures and that all personnel are following them. In addition, field-expedient methods should be reviewed and confirmed as appropriate. Many field-expedient methods once commonly used are not allowed now, but unless the review is conducted, soldiers may not know.

Leaders' Responsibilities

Analyzing motor-vehicle accidents raises the issue of whether or not training or the lack of it may have been contributing factors. There are lesson plans and training circulars that units or organizations should use to train their operators properly. In addition, hands-on training can supplement the training program and assist instructors in teaching all the hazards that exist in driving. Leaders of units using the M113 should ensure that their preventive maintenance program for the tracks is working properly. In addition, the seat bar for the track commander's seat should have any paint removed so the seat can fall when the release is pulled. The operation of this seat should be checked periodically. Leaders should also ensure that track commanders do not stand or sit out of the vehicle hatch more than the height of the name tag on their uniform from the ridge on the hatch. Conducting PMCS is another important practice for leaders. Properly training drivers and enforcing standards can reduce the number of mechanical problems that lead to accidents. Once shortcuts become routine, accidents will occur more frequently and with more severity.

Personnel must be reminded to take measures to ensure their own safety, such as being defensive drivers. Being in the "right" is no longer enough. They must also learn to anticipate other driver's actions and be prepared to take evasive actions. In vehicle convoys, field operations, or other exercises, keeping a watchful eye on other vehicles will go far in preventing accidents. If an operator is unsure of correct procedures or is not performing to standard, leaders must take the time to correct the problem. We still see POV accidents involving personnel who have consumed alcohol and/or were not wearing seat belts. Leaders must continue to emphasize the importance of not drinking and driving and of using seat belts.

Summary

As this analysis shows, POV accidents cause more deaths to engineer personnel than any other type of accident. This more than justifies the time commanders take to present holiday briefings and counsel soldiers who have received traffic tickets for moving violations. The analysis also shows that accident numbers are constant in most areas with a definite reduction in POV accidents and an increase in personnel injury–other. There is much more that can be learned about accidents; this article has only touched the surface. Each unit and organization should analyze its accident data and then take positive steps to reduce or eliminate hazards. The entire Engineer Branch will benefit from an across-the-board reduction in accidents.

For additional assistance in accident prevention measures, please visit the Maneuver Support Center Safety Web page at *http://www.wood.army.mil/safety/.*

Mr. Fanning is the safety director, Safety Office, U.S. Army MANSCEN, Fort Leonard Wood, Missouri.

Ms. Hall is a safety specialist, Safety Office, U.S. Army MANSCEN, Fort Leonard Wood.

Crossing the River "Regen": Regenerating Combat Power at NTC

By Lieutenant Colonel James A. Knowlton and Lieutenant Colonel Michael J. Teague

A rotation at the National Training Center (NTC) is one of the toughest training events a battalion will undertake. Fighting the World-Class Opposing Forces (OPFOR)—on their own turf—makes for an intense training event that challenges each and every member of a combat engineer battalion. But this is more than a big field training exercise; it truly is a campaign. Just deploying to a "hostile country" is a challenge. Drawing pre-positioned vehicles and equipment along with all classes of supplies—in a compressed time schedule—requires planning and organization to get into the maneuver box, ready to fight.

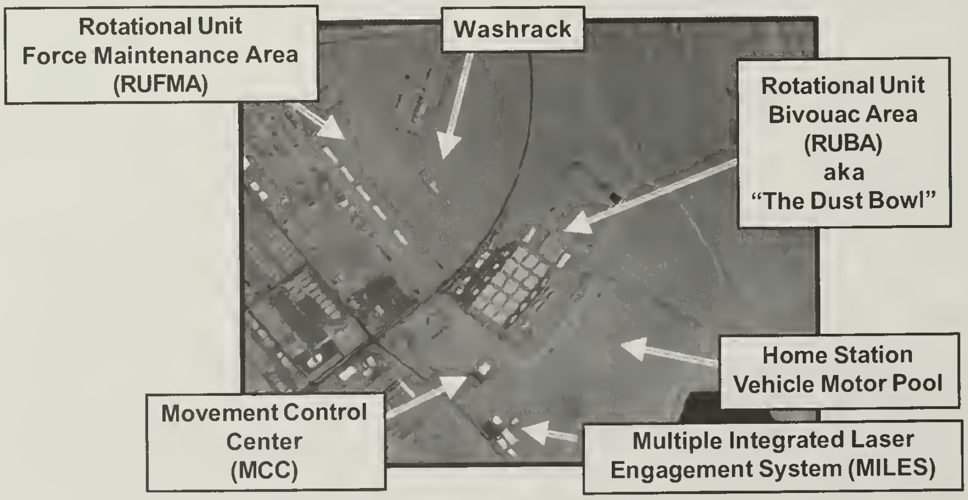
Unfortunately, once a battalion finishes battling the OPFOR, it is ready to sit back and bask in the glory that comes from working hard and successfully throttling the enemy, but this is when the "real fight" starts. The next phase of the campaign is turning all drawn equipment back to ITT, the contractor that owns and maintains the pre-positioned fleet at NTC. *This is the turbulent River "Regen" that your unit must cross in order to get everyone home!* Regeneration—or regen—is extremely difficult and can bring a unit to its knees if it has not properly prepared for this fight. Recently, the 4th Engineer Battalion, Fort Carson, Colorado, completed two rotations to NTC within seven months. During the second rotation, we were able to apply valuable lessons learned during our previous rotation. We returned to home station knowing that not only had we successfully battled the OPFOR, but we also had successfully "won" the regeneration fight!

The following system worked well for the 4th Engineer Battalion. In addition to being a compilation of our lessons learned, it also contains lessons from the experiences of other units. We are sure the system can be improved, but it is a great baseline to start with as a unit prepares for a rotation to NTC.

Regeneration Is a Mission

Like any other mission, regeneration requires thorough planning; an order; rehearsals; and solid command, control, and communications. It is a training event that should have its own after-action review (AAR). (That's where we captured the lessons learned from the first rotation.) As engineers, regeneration seems very similar to a river crossing. There is literally a hardball road between the "shores" of the turn-in yards, and the key to success is to get equipment to the far shore (ITT's side) and keep it there.

Since we knew there would be a "crossing" during this campaign, we started our planning before we left home station. We did a sand table of Irwin Military City and conducted rehearsals for reception, staging, onward movement, and integration (RSOI) and regeneration so that all of our leaders understood the terrain. The staff gathered tools that would be



critical during regeneration, and the units identified key leaders and operators for the process. We developed tracking charts for the draw grid that included every piece of equipment we would draw and had the tracking charts enlarged and laminated. We designed the charts as spreadsheets and used them as part of our nightly status report throughout both RSOI and regeneration.

We found it important to identify all vehicles by both their home station bumper numbers and the NTC admin numbers. ITT and the NTC Theater Support Command talk solely using NTC numbers, and by the end of regeneration, most soldiers and leaders are more comfortable with the NTC numbers than those of the home station.

As part of our unit's preparation, we brought office supplies specifically for regeneration, including accordion files for each company and job order folders for each vehicle and trailer. These folders became the key management tools to ensure that files were complete and allowed us to maintain positive control over all of the paperwork for each piece of equipment. This helped avoid the frustration of getting a vehicle ready for the final quality check and discovering that the air filter slip was missing.

Planning Is Critical

We wrote a separate operations order (OPORD) for the regeneration operation that covered the end of live fire through the turn-in of equipment and redeployment to home station. The OPORD covered moving out of and clearing the maneuver box and occupying the RUFMA. An OPORD shell was completed before deploying to NTC, and the staff planning was completed during the live-fire transition. We did not conduct a full rehearsal in the field, but each commander and primary staff officer back-briefed the battalion commander on his plan before departing the box.

A battalion can prepare in many ways for success during regeneration, but the most important step is for operators and supervisors to be ruthless about completing DA Forms 5988E, *Equipment Maintenance Worksheet*, and processing them through the maintenance system each day the unit is in the maneuver box. This is easier said than done when the OPFOR is pressing from all sides, you can't find the mine-clearing line charge (MICLIC) tags, and the observer/controller wants an AAR. But if you don't get low-density engineer parts on order early, your unit will spend additional days in the RUBA—also known as the "Dust Bowl"—waiting for parts instead of heading home.

In addition to working the Army maintenance system as designed, there are several other systems that you can implement within your unit to improve the probability of success. It was absolutely critical for us to designate one NCO to be in charge of locally purchased repair parts. The Theater Support Command maintenance tech is a wealth of information about local sources, but one NCO—who had a commercial vehicle and a government credit card and could run for parts—was a linchpin throughout the entire rotation. (Your installation resource manager will want you to keep track of the purchases for NTC versus home station vehicles.) You also need to understand the turn-in standard. Although the rumor mill told us that ITT would change the standards between drawing equipment and turning it in, we found that the ITT team was extremely fair. The team used an NTC Overprint 2404, *Equipment Inspection and Maintenance Worksheet*, for each vehicle rather than a 10/20 standard out of a technical manual. The same standard form is used at draw and turn-in time. In addition to daily DA Forms 5988E, our operators completed an NTC Overprint 2404 during live-fire transition to identify problems early and get parts on order before departing the maneuver box.

Finally, you must complete the Army Oil Analysis Program (AOAP) samples while the unit is in the maneuver box. This is easy to do, but it requires an NCO in the unit maintenance collection point (UMCP) to track each vehicle and ensure that each sample is collected and turned in and the results returned. ITT will not accept a vehicle without the proper AOAP paperwork.

Keys to Success

1. Purchase locally.
2. Use NTC Overprint 2404s.
3. Complete AOAP samples.

Start on the Right Foot

Once the final battle is over, the tendency is for units to sit back and relax for a day or two. After all, they have fought an intense campaign against the Krasnovian hordes over the previous 14 days and now deserve a break. This is the worst thing a unit can do because it puts it two days behind on recovery and turn-in. This is when leaders must be ready to execute an already-developed plan and execute it violently! Soldiers must understand that each day wasted up front is an extra day in the Dust Bowl. Once the unit finishes initial battlefield recovery in the maneuver box and begins redeployment to the Dust Bowl, everyone's focus must turn to regeneration.

The first part of the regeneration mission is redeploying from the maneuver box. Successfully accomplished, this postures the unit for the regeneration fight. We set up a drive-through station that was run by the engineer battalion Headquarters and Headquarters Company (HHC), which gathered all Class I, IV, and V supplies and trash from each of our units before it left the live-fire area. Our brigade combat team (BCT) conducted a four-corners (referring to the intersection of the two main range roads) drill that accomplished the same requirements outside the cantonment area, but most of the battalion's vehicles were able to drive straight through and into the RUFMA because they were already downloaded. When planning, don't forget the engineer piece of clearing training areas. You will have to fill in all the major holes, and there is no reason to race blade assets back to the RUFMA just to send them out again.

The quartering party for the battalion was the UMCP. The battalion maintenance technician (BMT) and battalion motor sergeant (BMS) set up shop in the trailer provided and were ready for the companies to arrive. They had marked vehicle lines by fleet, rather than by company, and the mechanics were ready for the vehicles. We consolidated all mechanics and reorganized by fleet: tracked, wheeled, and engineer. This aligns the unit's assets with ITT's crew organization.

Since most vehicles did not have to stop at four corners, the drawn vehicles immediately got into line for the washrack. This is the first step, and the line gets long. This is where great NCOs take over as they use the "down" time in line to remove the Multiple Integrated Laser Equipment System (MILES), download personal gear, and move home station equipment and sets, kits, and outfits to the MILVANs. This is also where home station vehicles separate from drawn vehicles. Home station equipment does not go through the washrack but goes right to the MILES warehouse. Drawn vehicles that were not mission-capable bypassed the washrack and went straight to the maintenance area. These vehicles were very specifically tracked, knowing that the ITT inspectors could not conduct the joint technical inspection (TI) until the operator washed the vehicle.

Vehicle Turn-In Process

Once we pushed drawn vehicles through the washrack, downloaded the MILES, and turned in items such as communications equipment and weapons, we parked them on line in the Dust Bowl. Once there, the vehicles did not move until ITT inspectors conducted the initial joint TI. This is the inspection that identifies the deficiencies operators will ultimately work off before they can turn in the vehicle. Units must be careful about pulling vehicles out of the RUFMA for a detail. During our first rotation, we had to pull an M916 truck and a loader out of the RUFMA—after ITT had already conducted the joint TI—to clear part of the training area. The operator had already worked off a great deal of the vehicle deficiencies, but he had to start over once he cleared the training area, a morale buster at best!

Steps for Vehicle Turn-In

1. Download.
2. Go through washrack.
3. Replace air filter and complete AOAP samples.
4. Perform joint TI with ITT.
5. Work off all deficiencies.
6. Obtain pass from line boss.
7. Go to final QA line.
8. Turn in or return to Step 5.

(Most vehicles will return to Step 5 several times before final turn-in.)

Each operator must replace the air filter on his vehicle as part of the regeneration process. This can be done before the joint TI, and the shop gives him a slip verifying that the filter has been replaced. Leaders must ensure that the slip gets into the vehicle's packet in the job order folder because no one can turn in a vehicle without one. This is where the folders become so important.

There is a line boss from ITT for each unit, and working with him as a teammate will make life much easier. Inspectors do not work for your line boss so you will have to coordinate for them to inspect your vehicles. *Get this done as soon as possible!* You can't order the right parts or work the right deficiencies until you have an NTC Overprint 2404 from the joint TI. Our BMT was the primary person who worked with the line boss, and the BMS worked with the inspectors. Everything was centralized through battalion maintenance with the BMT, BMS, and maintenance battle captain. This last part of the team was one of the tactical operations center (TOC) battle captains who ran all communications and reported from the trailer in the RUFMA to the rest of the leaders on the ground. Operators, squad leaders, platoon sergeants, and platoon leaders were not allowed to coordinate with the line boss. During both rotations, we saw operators lose their tempers because of frustration with a system they did not understand. Working with ITT—not against them—is the key to going home.

All of the maintenance clerks were inside the trailer under the control of the BMT and BMS. Their role is very important since no one wants to wait for parts that are the wrong ones! They must also remove all home station vehicles from the Unit-Level Logistics System (ULLS) box and turn in all of the recoverable parts. You will not leave NTC unless all recoverables are turned in or your unit pays double for the part or assembly. The AOAP monitor is also in the trailer making sure that the AOAP documents are correct and in each folder.

The battle captain controlled the folders for each vehicle and trailer and the draw grid spreadsheet. Unless a mechanic was working on the vehicle or it was in the final quality assurance (QA) line, the folder stayed in the trailer. The battle captain or BMT coordinated with the line boss to get the pass required to get into the final QA line.

Vehicle Packets

1. Air filter pass.
2. AOAP printout.
3. Joint TI 2404 with all deficiencies worked off.
4. Pass from line boss.
5. Clean DA Form 5988E.

Command, Control, and Communication

Once operators work off deficiencies, the next phase of the fight begins. At this point, it is important to get leaders at key locations to control vehicle flow and track the location of all unit vehicles. A lot of time is wasted if a vehicle fails a final inspection for a minor problem and the operator gets out of line when he could have gone to the quick-fix line and been finished in a matter of minutes. As with a river crossing, leadership on the ground was our solution to this problem.

We did not allow a vehicle to go to the final QA line without an NCO. After a while, we identified certain NCOs who were successful at turning in vehicles. That NCO is not always a mechanic; in our unit, our best guy was a motivated cook! We placed key leaders at critical points on the battlefield. The battle captain ran the maintenance trailer and tracked where every vehicle was in the turn-in process. The Alpha Company commander went to the final QA line, and the HHC commander went to a staging area located a few hundred yards before the final QA line. When the QA line got too long, ITT tightly controlled the vehicles that got in, regardless of whether they had a pass or not. We staged vehicles close to the QA line under the control of a commander and treated that location much like the engineer regulating point (ERP) before a crossing site. The Charlie Company commander was at the MILES warehouse, the S1 was in the MCC, and the S4 was turning in secondary loads and basic issue items. The battalion commander, executive officer, and command sergeant major moved among all of the sites. Since all leaders had communications equipment, it was easy to get one of the top three to a critical point on the regeneration battlefield when needed. Units without a senior leader in the RUFMA spent considerably more time before crossing the River Regen.

The RUFMA and the Dust Bowl did not seem very spacious, but by the second day, we had walked miles. Each leader must have communications equipment to provide status reports to the trailer as vehicles move in many directions throughout the RUFMA. AN/PRC-127 radios are the method of choice, but Motorola® and other handheld radios also work well. You cannot count on your vehicle radios since you will be turning them in or packing them for home station.

Each day after ITT shutdown, we conducted daily operations meetings to review the current status and establish priorities for that night and the next day. For us, it was a 24-hour-a-day operation, just like the training in the maneuver box, and we even executed a sleep plan to ensure that mechanics and operators were getting at least four hours of sleep each day.

The ITT line boss can be a tremendous asset. For vehicles requiring maintenance work above the capabilities of the BCT (depot level), the ITT line boss recommends arbitration. Then he coordinates and puts his recommendation on the arbitration process, and the unit turns the vehicle in with the required paperwork to go to the next maintenance level. We had several vehicles that went through arbitration. Establishing a good relationship with the line boss made this a less contentious process. He can also help with parts because he knows where most of the parts are throughout Fort Irwin and can point you in the right direction.

Almost Done, but Don't Stop Yet

Once you get down to the last 10 vehicles, ensure that you keep a sufficient number of key leaders and soldiers to complete the turn-in. The tendency is to try to get as many people home as you can (taking care of soldiers), and you end up short. Our forecasting rule for transportation was for a soldier to head home a full day *after* his vehicle was turned in. Since we worked 24 hours a day in the RUFMA, this gave everyone a chance to sleep, do laundry, and then start the manifest process. The standard was published in the regeneration OPORD, so everyone knew the rules up front.

We also kept several home station vehicles until the very end. All contact trucks, the wrecker, the Batmobile, and the tool truck stayed until the last day. If you don't have access to a commercial truck, you should also keep a cargo HMMWV to pick up parts and turn in recoverables. We contracted for three air compressors with impact wrenches to help in changing tracks and were able to return them when the last of the tracked vehicles were turned in. As the engineer battalion, you will probably be responsible for the environmental team of the White Cell, which means that you will be responsible for cleaning any spills in the RUFMA. We found it best to arrange for contracted equipment so drawn equipment can be turned in and home station equipment can be rail-loaded while still accomplishing the White Cell mission. You cannot use the same equipment you are turning in.

Conclusion

Every unit that goes to NTC learns a great deal from the experience. They get better with every fight and normally leave the maneuver box extremely proud of their combat readiness. One of the challenges that can bring a good unit to its knees is the regeneration process. The battle that awaits a unit when it comes out of the box is as tough as any fight it will experience at NTC. With proper preparation—both at home station and during the rotation—this final battle can be another streamer on the battalion colors. It's a great feeling to be the first battalion in the BCT to cross the River Regen and send soldiers home. This truly is the best way to end a successful campaign against the Krasnovian World-Class OPFOR!

Lieutenant Colonel Knowlton is the European Command exercise planner in J37, U.S. Space Command. At the time this article was written, he commanded the 4th Engineer Battalion, 4th Infantry Division, Fort Carson, Colorado. Previous assignments include the S3 and Assistant Division Engineer of the 307th Engineer Battalion, 82d Airborne Division, and company commander of units in Aschaffenburg and Berlin, Germany.

Lieutenant Colonel Teague is chief of training for the U.S. Army Space Command and was the battalion XO of the 4th Engineer Battalion, 4th Infantry Division, when this article was written. He previously served with the 10th and 19th Engineer Battalions and commanded the 13th Engineer Company (Construction Support).

Enlisted PERSCOM Notes

By Lieutenant Colonel Jack F. Smith

On behalf of the great staff here in Alexandria, Virginia, greetings from the Engineer Enlisted Branch. Having just arrived as the new branch chief, I am glad to have this opportunity to update you on the current health of the enlisted engineer force.

Health of the Regiment

The overall Engineer Regiment is very healthy. Today our Regiment is manned with 15 of 21 military occupational specialties (MOSs) at or above 100 percent with three more at 99 percent (see table).

Our biggest challenge is in the 12B MOS, particularly at skill level one. We underassessed this MOS during fiscal year (FY) 01 to correct a significant overstrength. The result of this and other corrective action is that the majority of units in the field are currently being manned below 95 percent at skill-level-one positions. Starting in October, we will bring in additional soldiers to increase our strength in this critical combat specialty.

Several actions taken over the past fiscal year have dramatically improved our low-density MOSs—00B, 52E, and airborne 62E/J. These should be healthy by the end of FY03. These MOSs offer very attractive reclassification bonuses under the Bonus Extension and Retraining Program. Call this office if you are interested in reclassifying into these specialties.

The shortage in noncommissioned officers (NCOs) continues to be problematic worldwide. While there are many reasons for the shortage, there really is only one solution. Soldiers in the field need to get scheduled for promotion boards. If you are eligible, ask your chain of command when you can go before the next promotion board.

Recruiting and retention have been well above historical averages across the Army and in the Engineer Regiment. All of our training seats were filled for FY02, and all the required seats for the first quarter FY03 have already been contracted. On the reenlistment side, all but one of our 21 specialties are well above the five-year historical trend. We expect this to continue, partly due to reenlistment bonuses, but most likely due to our ongoing campaign against terrorism.

The long-term projections for the Regiment are very good. We can expect our shortage MOSs (12B10, 00B, 52E) to improve dramatically in the next 12 months. Meanwhile, other specialties (51B, 51M, 51R, 51T) will experience decreases in overall strength to bring them in line with authorized manning levels.

The Assignment Process

The assignment process for enlisted soldiers is complicated, yet relatively simple. The complicated part is getting 15,000 soldiers properly aligned with so many priorities throughout the world for high-quality, trained, and ready soldiers. The simple part is that each soldier can have a direct impact on his or her assignment process.

There are many variables that go into the assignment process: exceptional family member program, married soldiers program , drill sergeant/recruiting nomination process, AC/RC, schooling, needs of the Army, deployment stabilization, and the all-important readiness of our field units. However, there is one thing that is not a variable, the soldier's preference. What has amazed me in my short time on the job is the number of both junior enlisted and NCOs who have not bothered to let Branch know their preferences. There are three methods to make this happen: You can submit a DA Form 4187, *Personnel*

Personnel Action

MOS	Authorized Strength	Strength (percent)
12B	8,161	99
12C	659	105
12Z	229	96
00B	138	99
51B	881	121
51H	434	104
51K	115	106
51M	241	99
51R	128	155
51T	116	99
51Z	116	103
52E	185	85
62E	1,342	105
62F	279	100
62H	99	98
62J	686	100
62N	459	104
81L	245	113
81T	460	101
81Z	19	105
82D	110	114
Total	15,243	98.5

Engineer Enlisted Operational Strengths (as of 4 September 2002)

Action, listing your assignment preferences; you can go online through Army Knowledge Online and use the Assignment Satisfaction Key (ASK); or you can call your assignment manager and tell him your preference. If you do the latter, you will be asked to follow up with a DA Form 4187 to document your preferences. ASK is the preferred method because that process eliminates the middleman. Your preferences are automatically posted to your record as soon as you hit the enter key. While we cannot guarantee that we can meet your preference in every assignment, I can guarantee that when we do have a valid requisition for a soldier, the first thing we look for is those who have listed that location on their preference.

When should you talk to your assignment manager? Often! We do work assignments for E-4s through E-6s six to eight months out from their report date. So if you've been at one location for over 36 months, your manager is already deciding where you will PCS to next. For those on short tours, about the time you arrive in country, you need to update your preferences.

For senior NCOs (E-7s and above), we are attempting to work your assignments so we can provide 12 months notification of a PCS. We have been improving, but we will never get to a 100 percent solution on this due to soldiers coming off levy, school scheduling, and the like. Here at Engineer Branch, we intend to start posting on our Web page critical assignments that we need to fill for selected senior NCO key billets with AC/RC and other jobs that are seldom easy to fill. Assignments can range from North Dakota to Hawaii, Egypt to Australia, and I think it will be a good opportunity to match up soldiers who want a deal of a lifetime to go to select locations.

I know there are soldiers reading this who are thinking, "What is this guy talking about? I got my orders exactly 32 days before the truck showed up at the house." There are a lot of reasons for this happening. Sometimes, but not often, the needs of the Army demand that we do a short-notice PCS, and we do everything in our power to avoid this. Another reason can be that some headquarters, for whatever reason, has not done its job of downloading assignment instructions and then publishing orders. If it has been more than 30 days since DA has informed you that you have been placed on assignment instructions, you need to go to your installation personnel office and find out what is holding up your orders. Here's a little secret: We post assignment instructions worldwide every Tuesday morning. Once posted, they are available for your installation personnel office to act on immediately. The key words here are "assignment instructions." Just because an assignment manager has told you that you have been nominated for an assignment does not mean assignment instructions have been published. The nomination process can take several months as the packet is vetted though all of the offices that ensure that only fully qualified soldiers are sent to critical duties such as recruiting and drill sergeant.

In some cases, and in some MOSs, the number of available worldwide billets and the number of soldiers to fill those billets can dramatically impact the amount of time a soldier can expect between PCSs. It is not uncommon to move soldiers with only 24 months on station to ensure the operational readiness of forward-deployed units. Many NCOs are also moved early when they are selected to recruiting or drill sergeant duty.

The bottom line to all of this is my charter to man the force with the soldiers we have available. My goal is to treat each of you with respect and to provide as much input as possible to your career. Periodically you need to contact your assignment manager or professional development NCO to review your assignment eligibility, preferences, and family circumstances. Keep in mind that there are restrictions about where we can send you. First, your MOS has to be authorized at the desired location. (Sorry, but there are no combat engineer slots in the Bahamas.) Also, if you have managed to avoid overseas duty for many years, we need to send you there, so step up and enjoy the scenery. We also attempt to avoid repetitive TDA assignments. If you are an NCO, you will need to do drill sergeant, recruiting, and/or AC/RC assignments at some point. These are nominative assignments that our best NCOs are asked to fill. They are challenging assignments and recognized by selection boards as being career-enhancing.

To the staff sergeant 12B ranks, we have a great career opportunity coming available this next summer. Our authorizations for 12B30 soldiers assigned to the Special Forces Civil Affairs Company will increase from 6 slots to 24. Get your packets together now if you want in on this great chance to serve your country on the edge.

Promotions and Training

This is one topic that has the interest of almost all soldiers. The single biggest item that stifles the process is the inordinate amount of board-eligible E-4s who are never given the opportunity to go before the promotion board. My philosophy is quite simple: If you have an E-4 in an E-5 or E-6 billet, then how can you possibly claim that the soldier is not ready for the promotion board. If he is already doing the job, he should already be getting the money. The promotion orders state only that the soldier has demonstrated "the potential" for the next higher grade. Sometimes it appears that some units want the soldiers "fully qualified" for the next higher grade. It takes about 10 years to get 10 years of experience that our great NCOs possess. Let some of the experience occur with the requisite increase in pay and rank.

Conditional promotions have been on the street for some time. Remember, they require attendance in the requisite NCOES course (PLDC, BNOC and ANOC) within one year of the conditional promotion. Failure to meet this requirement can result in a demotion. There are exceptions to policy for operational and hardship reasons; however, it is imperative that

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The Sapper Leader Course

By First Lieutenant Joseph Roman

The term "sapper" dates back to 16th century Europe when British engineers were given the name from the French word *sappe*, which described an entrenching tool used to construct ditches. The way of the sapper is hard and dangerous and lies always across the ground between friendly forces and the enemy. The job of the sapper calls for the best and the bravest in any Army.

"What is a sapper?" asked the British Royal Engineer, Captain T.W.J. Connolly, 80 years ago. "He is a man of all work of the Army and the public, astronomer, geologist, surveyor, draghtsmen, artist, architect, traveler, explorer, antiquary, mechanic, diver, soldier, and sailor, ready to do anything or go anywhere; in short, he is a SAPPER."

Today, almost all engineers consider themselves sappers. However, to the approximately 450 soldiers a year who challenge themselves and their soldiering skills at the Sapper Leader Course (SLC) at Fort Leonard Wood, Missouri, the term means so much more.

Graduates from the SLC are physically tough, mentally proficient, and tactically sound. They volunteered to undergo some of the most rigorous training the Corps of Engineers has to offer. They successfully trained for 28 days at an average of 17.5 hours a day. They learned advanced skills necessary to be a strong combat multiplier for their task force. They earned the right to be called sapper.

Sappers must arrive at the course in peak physical condition. They begin their training with a standard Army Physical Fitness Test and basic in-processing requirements. The challenge often lies in the increased elevation provided by the Ozark Mountains and the demanding weather of the Midwest. All soldiers are eligible to attend the SLC, regardless of their military occupational specialty or gender. Although the majority of the students are combat engineers, any soldier with a strong train-up can be successful at the SLC. All are in the rank of E-4 or above, but they must have a waiver if they are not E-4 (P). Following their day of acclimatization, the sapper candidates begin one of the most rigorous training schedules they will ever face.

The connotation of combat engineer implies proficiency with demolitions. To ensure that this image is upheld, the SLC includes more than two days of instruction on safe and efficient employment of a variety of charges. A full day is dedicated to classroom instruction on safety, system emplacement, and charge calculation. A written examination confirms their proficiency and allows younger soldiers the opportunity to understand the mechanics of demolition placement. This instruction is validated with an overnight stay at a demolition range. The SLC is currently moving its operations to the new engineer qualification range, where a variety of charges will be discussed and emplaced. To complement the contemporary operating environment, an increased focus is being placed on charges used in military operations in urban terrain that focus on safety and a low standoff radius. Furthermore, sappers learn to construct field-expedient charges based on realistic supplies and contemporary missions.

In addition to the mobility support provided by the demolitions expertise, sappers also learn to move their task force through the water. Training is conducted at the Lake of the Ozarks, where students get hands-on training with Zodiac boats in addition to field-expedient methods for crossing wet gaps. This training is complemented by instruction in crossing site reconnaissance, assault crossing, and setup. While the primary training lies in the efficient construction and use of the boats, students also are able to overcome fear of the water and moving heavy loads across gaps they might not normally swim. Based on the weather and aircraft availability, some classes have the opportunity to helocast and learn the technicalities of nonstandard theater entry. The water, however, is not the only obstacle sappers learn to conquer.

Three days of the SLC are dedicated to mountaineering operations. Sappers are first introduced to ropes and the proper care and use of these essential items of equipment. They learn to tie knots that are incorporated in many of the individual and collective tasks used throughout the course. Additionally, they construct one-rope bridges and an A-frame to enhance both horizontal and vertical mobility. Sappers then practice ascent and descent techniques on a tower and at our own cliff site. In addition to individual rappels and climbs, students learn the essentials for casualty evacuation down a vertical drop and practice these techniques. The training culminates with a 90-foot night rappel with equipment.

Sappers not only must provide mobility but also must identify and combat the enemy. To this end, a day is dedicated to enemy capabilities. Sappers are introduced to some of the most common mines in the world today. An instructor fresh from Afghanistan who received hands-on training on our enemy's "weapon of choice" teaches this training. By learning to successfully identify these weapons, engineers can make a greater impact in the planning and reconnaissance of their task force.

Additionally, students are taught the components and capabilities of the most common rifles in the world. Students are then able to assemble and disassemble an AK-series weapon and, in the coming months, will be able to fire these weapons, see their capabilities firsthand, and learn their signature sound. Furthermore, sappers learn the intricacies of booby trap employment and detection. Classroom instruction is provided to familiarize students not only with the conventional booby traps available via normal supply channels but also innovations commonly seen throughout the world. Students construct their own booby traps, limited only by their imagination, and then clear lanes produced by other students to enhance detection and disarming abilities.

Finally, students are given an introduction to air operations. A sapper has knowledge of airborne, air assault, and pathfinder operations and landing/pickup zone setup and operations. Additionally, students soon begin training on fast rope techniques on our tower. They are required to put this knowledge to the test by guiding in an actual aircraft and controlling its operations based on the classes they received.

Intermixed throughout the beginning two weeks of class are various exams to test the proficiency and physical toughness of the students. A 12-mile road march, which is regularly described as the toughest course the students have ever walked, is given at the end of the first week. While the three-hour time limit is difficult, it is clearly attainable for anyone who trained at home station. Following the road march, a medical techniques class is given to check the students' knowledge, which includes applying an IV to fellow students to replenish fluids lost during the march. Additionally, students are paired up and complete a land navigation course that can best be described as humbling. The majority of the attrition at the SLC comes from this event, with injuries as the second largest reason for not completing the course. Again, home station training and toughening are the keys to success.

Following two weeks of intense individual training, students then transition into the patrolling phase of the SLC. Here, they are required to put all their newly acquired knowledge to work in a field environment. They begin with a few days in a classroom, simply to arm themselves with a working knowledge of basic patrolling methods and small-unit leadership skills. Although students should show up with some experience, the standardization allows the class to better perform as a sapper platoon for their upcoming 10-day field problem.

While the focus of the field problem is the successful employment of the five basic principles of patrolling, the SLC is shifting the patrolling missions toward more of an engineer focus. Students will rotate through leadership positions and

Staff Sergeant Plimpton conducts jump master personnel inspection.

Sapper students prepare to rappel from the tower.

will each face some unique and challenging tactical problems requiring detailed planning, focused leadership, and violent execution.

To better represent the contemporary operating environment, students will now see an increased mobility requirement in their patrols. Challenging breaches will be necessary to fully close with and destroy the enemy, along with a more challenging enemy objective. To better replicate an actual mission, objectives are being rebuilt which will require detailed analysis on-site to effectively destroy enemy equipment. Also, the vertical and horizontal mobility skills learned during the previous weeks will be necessary to complete all missions issued. Mobility, however, is not the only skill that is trained at the SLC.

As the Army shifts to a smarter mine system, so too will the SLC. To be successful, students should show up at the SLC with a working knowledge of all the mine systems available to them, as some missions will require hasty defenses or mine incorporation in an ambush. These, mixed with traditional wire obstacle construction, will be a good refresher for students and better illustrate the difficulty of emplacing obstacles under demanding physical and mental conditions. Mine emplacement must complement mine awareness, as students will be forced to extract both themselves and friendly forces from minefields. Lessons learned in recent years preach extraction methodology, and the SLC helps hone these skills. Of course, with extraction comes the implied task of identifying and marking minefields.

Culminating the SLC field problem, students will be required to perform a live breach using mechanized transportation. While the mechanized lifestyle cannot be replicated, this mission will provide an introduction for light fighters and a chance for mechanized soldiers to shine in their own environment. Following a dismounted route clearance, students will link up with transportation and finish their field problem.

The field environment is demanding, with students getting little sleep or food if a team environment is not present. Students who show up in top physical shape can best handle the stresses induced by these harsh conditions. However, the stress and their body's reaction are some of the best training that students claim they receive. Similar to a field problem at Ranger School, students learn how their body will react, how to push their mental and physical limits, and how to lead another student who only wants to close his eyes.

Success at the SLC depends on a quality train-up program. Units are encouraged to send students with their leadership to better foster a team environment. Historically, when this happens, graduation rates increase significantly and individual training is complemented with a strong team unity upon returning to their home station. The unit should prepare for the SLC by conducting tough physical training daily, focusing on road marching. Additionally, students should arrive with a basic understanding of math skills and basic demolitions calculations. Land navigation is a critical, yet perishable, skill that dooms the majority of sapper candidates. About one of every three sappers who do not graduate did not successfully complete the land navigation course. Students cannot learn to move cross-country in an hour block of instruction. They must practice before arriving at Fort Leonard Wood. An introduction to basic knots will enhance the students' performance during the mountaineering portion of the SLC.

Finally, sappers must show up knowing their jobs as combat engineers. Many basic skills are required during the field problem; however, they are not taught at the SLC. For example, students are expected to know their own weapon systems, how to breach, and how to emplace a minefield. Students who struggle with their basic individual tasks will not be able to focus on the development of their leadership skills. Units do best when their NCOs and leadership accompany their young soldiers through the SLC.

Students who meet all graduation requirements know the meaning of the word sapper. They understand how to best utilize all of their engineering and soldiering skills to strengthen their task force. Those who complete the course but do not graduate return to their units much stronger soldiers and more effective leaders. No one leaves the SLC without a better knowledge of himself, his equipment, or his soldiers. The SLC emphasizes the ability to organize on the move and transition quickly along the spectrum of conflict, and it trains leaders to be adaptive.The SLC is relevant with the new core competencies and imperatives in FM 1, *The Army*.

Questions about the SLC can be directed to *romanj@wood.army.mil*. You can visit our Web site at *www.wood.army.mil/sapper*.

First Lieutenant Roman completed EOBC in 2000. Following Ranger School, he was assigned as a platoon leader in the 307th Engineer Battalion, Fort Bragg, North Carolina. After serving as a company executive officer, he became chief of training at the Sapper Leader Course.

Command—Challenging and Rewarding

By Captain Dale Snider

Company command can be the most challenging and rewarding period of personal sacrifice and professional growth an engineer captain may ever experience. As commander of an engineer construction company (combat heavy), I experienced the greatest ups and downs of my 10 years with the Army. I would like to share my experiences with you in an attempt to help you avoid my early mistakes and allow you to build on my company's successes. The areas I focused on during my command, in their order of priority, were basic soldier discipline, training, leader development, and maintenance.

Basic Soldier Discipline

To me, basic soldier discipline is the underpinning of everything a unit does and does not do. Upon entering command, I believed if my company was disciplined, it could function as a unit in the most difficult of environments, and individuals would act professionally and ethically even when no one was watching. I believed that a disciplined unit could be given a mission it had never trained on and still be successful because the soldiers and NCOs would be thoughtful, creative, and safe in executing an unfamiliar mission. I also believe history teaches that, in a developing theater of war, it is critical that units be able to execute missions that are unfamiliar at a tactical level for strategic missions to be successful.

I tried to create a disciplined company by supporting and reinforcing the authority of the company's NCOs. When an NCO gave an order, it was to be obeyed. There was no compromise in this area. If an NCO told a soldier to do something and the order was lawful, ethical, and moral (and I never had an NCO give an order that was otherwise), I supported that order with the full weight of corrective training and the Uniform Code of Military Justice.

I also stressed the use of the chain of command. I required that when soldiers came to see me, they had already talked to their squad leader and platoon sergeant or platoon leader. I ensured that all soldiers' administrative requests had been reviewed by their chain of command. I believed that this reinforcement would solidify, in both the soldiers and their chain of command, that their chain of command was responsible for their welfare in every area. As a result of these efforts, our company had fewer military police reports and soldier and NCO discipline problems than our sister companies over an 18-month period.

Training

Training, training, training—virtually everything an individual soldier and a unit does is training of some kind at some organizational level. Training is dynamic, fluid, and the one organizational area that should be attacked with every asset in the company with as much vigor and aggressiveness as possible—then require 20 percent more from your subordinates.

I approached training objectives by putting all training events of squad size or larger on the company training calendar as far out as possible. Usually, scheduling 8 to12 weeks out would still give company leaders clear objectives for the training event. These events on the calendar became "stakes in the ground" on which the company focused. The stakes acted as anchors for organizational effort such as hip-pocket training, short-term training, maintenance preparation, and supply actions. I was regularly surprised at how these stakes affected the company. For example, I heard team leaders planning training materials—such as Class II and Class IX—with the maintenance platoon sergeant and supply sergeant, so their team would be successful.

At the weekly training meetings, we synchronized the training calendar with all leaders. We started with tomorrow and worked our way through the calendar day by day until we reached T+ three months. Normally, we reviewed only squad-sized and larger events. I required that the officer or NCO in charge of whichever event we were currently reviewing answer *when*, *where*, and *who*. For example, for events such as the Army Physical Fitness Test, *who* was required to take the test, *when* and *where* was it going to be given, and *who* would be grading (by name).

I planned backward, with the company's leaders, the major events that would prepare our unit for the upcoming training:

- Warning order and operations order briefs
- Lieutenant and key-leader lunches (where we reviewed training objectives and mission training plan leader tasks and clarified my intent)
- Company in-progress reviews (IPRs)
- Rehearsals at both platoon and company levels
- Back briefs and milestone reviews (to track critical requirements that would ensure a successful company preparation) (See Figure 1, page 38)

Week 1		Monday's PMCS
Monday	Platoon sergeant (PSG) picks up DA Form 5988 at 0900. Operators perform PMCS on equipment and identify high-priority faults. Mechanics are assigned to each platoon and initiate repairs.	Perform PMCS on the following: Dozers (338,339,340,341,342) Scrapers (314,315,316,317) Fuelers (302,303) 5-ton trucks (102-230) Trailers (102A-230A)
Tuesday	Operators look up low- and routine-priority parts and NSNs and check DA Form 5988 against parts received/installed. PSG and platoon leaders (PLs) review and check for discrepancies.	
Wednesday	PLs brief DA Form 5988 with XO and maintenance section.	
Thursday	Maintenance platoon performs PMCS on its equipment.	
Friday	Mechanics continue repairs and services.	
Week 2		Perform PMCS on the following: HMMWV (300,301) Light sets (300T, 301T) 5-ton/2.5-ton trucks (304,305) 105 trailers (304T, 305T) Scoop loaders (312,313) 916s (331,332,333,334,335,336,337) SEE and crane Rollers (325,326,327,328) 870s (331T,332T,333T,334T,335T) Water trailers (336T,337T) Tampers, pumps, generators
Monday	Perform PMCS with last week's DA Form 5988. Mechanics continue to verify, repair, and perform services.	
Tuesday	Operators look up low- and routine-priority parts and NSNs and check DA Form 5988 against parts received/installed. PSG and PLs review and check for discrepancies.	
Wednesday	PLs brief DA Form 5988 with XO and maintenance section.	
Thursday	Maintenance platoon performs PMCS on its tools and shop equipment.	
Friday	Print new DA Forms 5988 for the following week.	

Figure 1. Two-Week Maintenance Cycle

- Vehicle staging in serial order (to focus the company on the upcoming convoy and the associated convoy briefs, internal commo checks, load plans, commo rehearsals, and leaders' recons)

If the mission, enemy, terrain, troops, and time available (METT-T) allowed, I took the XO and other key elements to the expected company tactical assembly area (TAA) and reconnoitered major training sites and talked through the training plan and critical timing. This really helped during the weeks before the company deployed. As questions came up, the XO and others could provide intelligent answers. This early recon also brought up many good questions that we worked on before deployment.

The XO talked the leaders through the TAA setup, timeline for day one, and platoon's sectors. During this second recon, there were opportunities to conduct hip-pocket training for the lieutenants in areas such as terrain association.

Leader Development

I know from personal experience that leaders are not born, they are developed. And developing strong, self-confident, competent leaders takes thought, patience, and effort. Leader development was a training event I planned for and tried to find opportunities "in the moment" to train.

I approached leader development by putting an event, such as a rock drill, on the calendar. Then we set up the event by preparing the site, sand tables, timelines to be reviewed, and briefers. My goal was for the key leaders to be a part of the drill and see how an effective rock drill was set up and executed. I used this same method of training for teaching lieutenants how to execute training meetings, IPRs, back briefs, leaders' huddles, and after-action reviews. In environments such as convoys or platoon movements, soldiers helped by acting as larger elements during these training sessions and moved from one rock or dirt pile in a quickly created but large sand table by time sequence or phase lines.

Training could be fun and demanding at the same time by running squad competitions at individual and squad-level events. These events would continue over a period of several weeks. We also initiated constructive competitions among the platoons in physical training (PT) and in scheduled sports by running a company multisport, single-elimination challenge roster on Tuesdays during PT. All of these leader development events were intended to build individual and team self-confidence, while training and bonding us as a unit.

Maintenance

Army doctrine says that maintenance is training, but I believed it was so vital to our unit's mission accomplishment that we created a separate area of emphasis. Before taking command, I spent 18 months as the battalion maintenance officer. During that time, I saw maintenance platoons with too little time to accomplish all that was required of them and a DA Form 5988E, *Equipment Maintenance Worksheet*, flow that was paper heavy because of a too frequent cycle. This delay often demoralized operators because they repeatedly wrote down the same routine or low-priority faults without getting action from the maintenance platoon. In addition, low-density equipment such as hand tampers, saws, pumps, and generators received less attention than they deserved. To respond to these areas, we created a two-week maintenance cycle (see Figure 2) that allowed time for

Milestone	1st Platoon	2d Platoon	Earthmoving Platoon
Identify MTP tasks to be trained/evaluated			
Identify platoon construction project for FTX	29 Sep 00		26 Sep 00
Identify training area (for bivouac)	20 Sep 00		
Conduct site reconnaissance	4 Oct 00		
Turn in milestones		20 Sep 00	
Establish timeline for FTX		5 Oct 00	
Brief commander on milestones, timeline, tasks to be trained			
Brief commander on OPORD, convoy plan, risk assessment		10 Oct 00	
Issue MTP tasks to be trained/evaluated			
Issue warning order to platoon	21 Sep 00		25 Oct 00
Request training area			TBD
Request Class I		3 Oct 00	
Request Class III			
Request Class IV		ASAP	
Request Class V (and pickup date)			
Request MILES			
Request miscellaneous expendable supplies			16 Oct 00
Request field sanitation support	3 Oct 00		16 Oct 00
Submit convoy request to XO	20 Oct 00	10 Oct 00	20 Oct 00
Schedule washrack			
Submit equipment packing list	16 Oct 00		16 Oct 00
Issue packing list to platoon			
Issue precombat checks for platoon FTX construction project	16 Oct 00		TBD
Pick up approved training area request			23-27 Oct 00
Draw Class I		3 Nov 00	
Draw Class V			
Draw and zero MILES			
Draw miscellaneous expendable supplies			
Establish field sanitation on bivouac site			06 Nov 00
Issue OPORD to platoon	5 Oct 00	23 Oct 00	3 Nov 00
Brief evaluators			
Brief opposing force			
Inspect individual equipment	03 1600 Nov 00	30 Oct 00	30 1300 Oct 00
Load equipment onto vehicles	30 Oct - 3 Nov 00		2 Nov 00
Ensure load plans are complete			31 Oct 00
Ensure vehicles are topped off with fuel	03 1500 Nov 00	2 Nov 00	
Perform PMCS on vehicles and equipment	30 Oct - 3 Nov 00		30 Oct - 3 Nov 00
Perform PCCs and precombat inspections (platoon equipment)	03 1500-1700 Nov 00	2 Nov 00	03 1300-1600 Nov 00
Perform rehearsals		2 Nov 00	
Dispatch vehicles	03 1500 Nov 00		
Stage vehicles	03 1500 Nov 00	3 Nov 00	03 1130 Nov 00
Draw weapons		06 0530 Nov 00	06 0600 Nov 00
Draw Automatic Net Control System		06 0600 Nov 00	06 0600 Nov 00
Fill radios; establish and verify commo	06 0600 Nov 00		06 0730 Nov 00
Account for personnel and sensitive items			06 0600 Nov 00
Eat breakfast		06 0730 Nov 00	
Give convoy brief	06 0830 Nov 00	06 0830 Nov 00	06 0830 Nov 00
Deploy	06 0900 Nov 00	06 0915 Nov 00	06 0900 Nov 00
Conduct FTX	6-9 Nov 00	6-9 Nov 00	6-9 Nov 00

Figure 2. November 2000 FTX Milestones

the maintenance platoon to respond to all priority faults and involve operators in the parts-ordering process.

We had Command Maintenance Week One where we used new DA Forms 5988E to record preventive maintenance checks and services (PMCS) performed on all prime movers and trailers on the first day of the week. Then, over the next two days, the maintenance platoon verified the faults and the operators ordered all routine and low-priority parts. When we first started this program, all NCOs and officers were trained on how to look up and order parts using a parts request form and the appropriate technical manual (TM).

A TM library was created for the operators separate from the one used by the maintenance platoon. We also created a cross-reference sheet that showed the operators which TMs went with each piece of equipment. This process of having operators order their own equipment parts did two things for our unit: It created ownership and involvement in the maintenance process by the owners of the equipment, and it freed up a tremendous amount of time for the maintenance platoon to work off deadlines and required services.

The second week of our two-week cycle was identified on our company training calendar as Command Maintenance Week Two. During this week, we performed PMCS on and cleaned and lubricated the low-density equipment such as hand tampers, generators, and skill saws. The rest of the week was the same as week one. Another change we made to this week was to move command maintenance for the maintenance platoon to Thursday afternoon. This allowed the maintenance platoon to be with the rest of the company on Monday to perform simple fixes and work on equipment that was identified as not mission capable during PMCS. Our two-week maintenance cycle was adopted by our sister companies, and it became the battalion standard.

I made it a point to be available to all soldiers. I only closed my office door when absolutely necessary and spent as much time as possible at the project sites, with the platoons during PT, and on the weapon ranges. When a group of soldiers conducted training, I went out to be with them. My intent was to get to know the soldiers by name and learn something about their families, where they were from, or what their hobbies were. One of the best things about being a commander is getting to know America's sons and daughters and becoming a team member in the best of America's organizations. Of all the things you do during command, spending time with your soldiers, hearing their stories, and helping them solve their problems will be the most rewarding. If you are not committed to the well-being of the soldiers or are not willing to take on their issues to help solve them, then my advice is to turn down command and help your unit through good staff work.

Summary

In my opinion, if you pick more than four or five areas on which to really focus during your command, you will spread yourself too thin and be less successful in the areas you are most interested in. Command time means that you will sacrifice family time and personal interests, but you will be compensated by professional development and acceptance by the NCOs and soldiers as the commander of a great organization.

You may contact Captain Snider at *martin.dale.snider@us.army.mil*

Captain Snider is pursuing a master's in construction management at Texas A&M. He previously commanded A Company, 52d Engineer Battalion, Fort Carson, Colorado, and served as the assistant S3 and battalion maintenance officer. CPT Snider is a graduate of Texas Tech University and the Field Artillery Officer Advanced Course.

(Enlisted PERSCOM Notes, continued from page 33)

you attend the NCOES courses as soon as possible. Do not hesitate to contact this office if you have questions about NCOES attendance or conditional promotions.

For information on pending selection boards, visit the PERSCOM Web site *(www.perscom.army.net)* for the latest news. It's up to you to review your Official Military Personnel File. You can obtain a copy by following the procedures posted at our Web site.

Contacting Us

The sole function of Engineer Branch is to support soldiers and commanders in the field. I encourage you to contact your assignment manager PDNCO, Branch sergeant major, or me with any questions about assignments or professional development. The PERSCOM Web site has all the information on how to contact us. Remember, the only thing in the assignment process that does not have to be a variable is your preference. Take the time to let us know your preference.

Lieutenant Colonel Smith is chief of the Engineer Enlisted Branch in the U.S. Total Army PERSCOM. Other assignments include commander, 44th Engineer Battalion (Brokenheart), Camp Howze, Korea; war plans analyst, U.S. Strategic Command, Offutt Air Force Base, Nebraska; and executive officer, 20th Engineer Battalion, 1st Cavalry Division, Fort Hood, Texas. He has a master's in nuclear engineering from Penn State, a master's in military science from the Advanced School of Military studies, and a master's in strategic studies from the Army War College.

TRAINING MODEL OF POLISH EOD ENGINEERS

By Colonel Andrzej Zarczynski

Since the end of World War II, Polish engineers have taken part in numerous peacekeeping missions. During these missions, mine-clearing operations have been the main task of explosive ordnance disposal (EOD) teams. Mines have become a very simple and effective means of battle, because most of them are simple to construct, inexpensive to manufacture, and easy to use. Mines have now become one of the principal threats to NATO and UN operations and soldiers. Clearing these mines is not only costly and slow but also extremely dangerous. Therefore, engineers from EOD teams must be specially trained if they are to be involved in mine-clearing operations.

The Polish armed forces train young engineer officers for assignments as EOD platoon leaders, warrant officers and noncommissioned officers as EOD team leaders, and conscripts as EOD team members.

Peace Support Training

Training Polish engineer soldiers for EOD team operations consists of three phases:

Skills Training

This six-month phase is conducted in selected military engineer units within Poland, where soldiers learn the basics in Polish military doctrine on mine operations. They learn the types of mines and minefields (purpose, description, and method of operation and handling) and the methods of laying and removing mines. Soldiers also receive instructions on minefield construction, such as where to use antipersonnel or antitank mines and the kinds of mines to use in various areas (fields, forests, roads, etc.).

The soldiers receive extensive training in mine-clearing operations, which includes—

- Methods of marking and fencing minefields and minefield lanes.
- Basic rules of safety during mine-clearing operations (for example, the minimum safe distances for mine clearance and EOD operations appropriate to the threat of blast and shrapnel).
- Disposal procedures during electrical and safety fuse methods of blast initiation.

During this time, engineer officers (who have graduated from the Military Academy) and warrant officers or NCOs (who are graduates of the Engineering Training Centre in Wroclaw) respectively serve as platoon leaders and squad leaders in a military engineer unit.

After their initial six months of training, conscripts—if appointed to serve in a mission area—and a cadre from a selected military unit take part in a ten-day course at the

A soldier uses a probe during mine detection training.

Engineering Training Centre, training to be EOD team members. These soldiers prepare for a specific mission area. Currently, we train EOD soldiers for operations in Lebanon, Syria, Kosovo, Bosnia, and Afghanistan.

Correlate Training

During this five-week phase, training for UN peacekeeping missions is conducted at the Sikorski Military Training Centre in Kielce. Training for NATO missions is at selected military engineer units in Poland. During this phase, soldiers are specially trained in EOD mine-clearing operations.

Advanced Training

The last phase of training is conducted in the mission area (for example, Kosovo) for five days. The newly arrived team receives instruction on the operational environment from the team that is currently in the mission area. During this phase, the two teams develop a training plan and use actual mines, which have been rendered safe, that the conflicting sides have been known to use in that area.

Engineering Training Centre

Training at the Engineering Training Centre consists of classroom instruction, followed by practical field training. The classroom instruction, which comprises about 10 to15 percent of the training syllabus, is conducted at the Engineering Training Centre. The practical field training is conducted at selected battle camp locations that are specifically designated to train Polish EOD personnel.

During the classroom instruction, there are lectures about current ongoing UN or NATO missions; characteristics of antipersonnel and antitank mines, unexploded ordnance (UXO), and booby traps; and other mine-related threats. The instructors have a wealth of experience to share with the students, because each instructor has completed at least one rotation in an actual mission area. Additionally, we use a great deal of original documentation, such as mission instructions and operational maps, from mission areas where Polish soldiers have been and are currently operating.

Training Requirements and Content

EOD teams are trained according to NATO or UN procedures and Polish doctrine. There are many standard operating procedures (SOPs) and instructions that we profit from during training. We continually revise and develop training materials (training aids, instruction syllabi, and drafts) to better train our soldiers. Recently, we produced a detailed mine-clearing video based on actual operational mission experience to supplement the standard training package. Our operations experiences have been published in military magazines, including an article titled "Mine Threats in Mission Areas" in the February 2001 issue of *Engineer*.

Methods of Work

Soldiers receive training in individual and panel activities during mine-clearing operations. In addition, they learn the dangers of handling ammunition and UXO. Every Polish EOD engineer soldier is trained in—

- Detection–using various kinds of equipment, such as probes, types of mine detectors, and grapnels.
- Identification and on-site evaluation–identifying types of mines, ammunition, and UXO that may be encountered in a particular mission area.
- Rendering safe or recovery–being able to operate independently and having the self-confidence to know how to render safe or recover mines, ammunition, or UXO.
- Final disposal of mines, ammunition, and UXO–performing demolition or burning in place, removal to a disposal area, or other means appropriate to the mission area.

During training, we use mines that were used in previous military conflicts and have been rendered safe. We now have about 100 drill mines from current conflict zones. (There are about 700 types of mines in use worldwide, with more than 300 of them being antipersonnel mines.)

Booby Traps

The construction of booby traps depends greatly on the inventiveness of the people and soldiers who make them. They are normally made of readily available, commonly used items and military equipment such as a weapon or bayonet. We train our soldiers on the methods of preparing booby traps, to include the various types, the materials that can be used to construct them, and where they can be used effectively. As always, special attention is devoted to the history and details of the use of booby traps that soldiers may encounter in a specific area of operation. Our training, based on operational experience, includes the following examples:

- An antitank mine is connected to an inductive short-circuiting switch by an electric circuit. The inductive short-circuiting is situated adjacent to an antitank mine. When a mine is swept by a mine detector during clearing operations, the detector generates an electromagnetic impulse, which causes the electric circuit to close and the antitank mine to detonate.
- A direction mine is connected to a plate short-circuiting switch (an aluminium plate and a pressure plate with nails) by an electric circuit. When the pressure plate is stepped on, it perforates the aluminum plate, which causes the electric circuit to close and the mine to detonate.
- Military equipment (such as a weapon, sidearm, or binoculars) is connected to TNT or a mine by wires to an electric circuit or antihandling device. When the equipment is moved or lifted, the TNT or mine detonates.
- Maps in a briefcase are attached to TNT by an electric circuit. When the maps are taken out of the briefcase, the electric circuit closes and the TNT detonates.
- Ammunition or an antitank mine is buried under another antitank mine. An antihandling device connects the two, and the mines could detonate when the first one is lifted.
- A grenade in a glass is attached to a door or window handle. When the door or window is opened, the device falls out of the glass and detonates.
- A bounding (or fragmentation) mine is connected to a shovel by a trip wire. When the shovel is lifted, the mine detonates.
- TNT is placed in a telephone, videocassette, or night lamp. When the receiver is lifted, the videocassette opens or the night lamp switches on, a fuse activates, and the TNT detonates.

Safety Rules

Soldiers are given instructions on safe distances for conducting mine clearance and EOD operations appropriate to the threat of blast and shrapnel. This is achieved by ensuring strict adherence to SOPs and established NATO or UN procedures and training doctrine. Safety procedures also require soldiers to wear personal protective equipment (full body armor, helmets, and visors) during mine-clearing operations.

Minefields and Minefield Lanes

We train our soldiers to mark and fence minefields and minefield lanes according to current NATO or UN procedures, as required within the mission area.

A soldier trains on antitank mine render-safe procedures.

Psychological Aspects

EOD engineers are trained on the psychological impact of constantly dealing with antitank and antipersonnel mines and booby traps. During training, we show new soldiers films and photos of mine accidents to increase their sense of safety and reinforce the proper procedures for handling explosive devices.

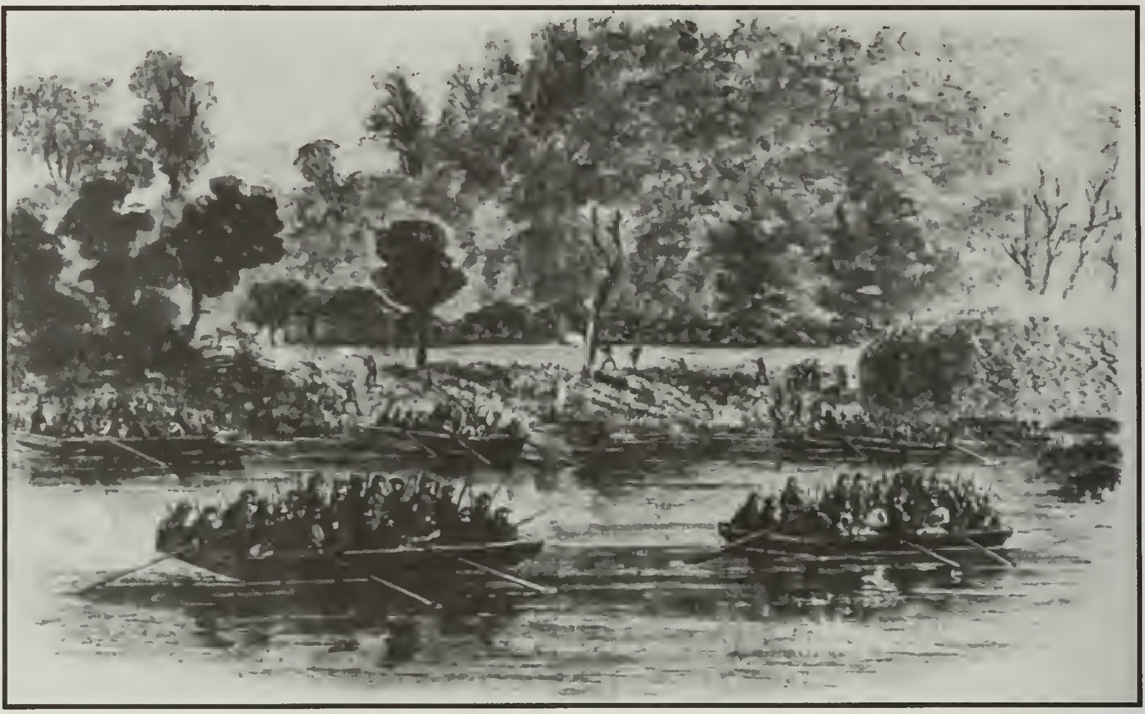
First Aid

Soldiers are trained to provide immediate first aid to mine victims, and they learn the proper procedures for requesting medical evacuation of casualties.

Conclusion

Our training model and education prepare excellent engineer soldiers for EOD teams, as demonstrated by their continued high-quality performance during actual operational missions. During both training and mine-clearing operations, we teach soldiers to be safety conscious and impress on them that their actions can ensure the safety of the local civilian population and the environment. Our training program is intensive and focused. And it benefits greatly from having cadre with actual operational field experience to teach the next generation of engineer EOD specialists.

Colonel Zarczynski, an officer in the Polish armed forces, is currently the chief of the Engineer Branch, HQ SFOR, Sarajevo/Butmir, Bosnia and Herzegovina. He also has served in the UNEF mission in Sinai, the UNPROFOR mission in Croatia, and the ASIDT in Albania. Colonel Zarczynski is head of the Tactics Department of the Engineering Training Centre, Tadeusz Koscinszko Military Academy, Wroclaw, Poland, where he trains Polish engineering units for UN and NATO missions.



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Bridging the Tennessee River

By Captain Darman Place

On 27 October 1863, Brigadier General William "Baldy" Smith (see photo), Chief of Staff and chief engineer for the western army, emplaced a pontoon bridge across the Tennessee River. This bridge was the key link in creating a supply line—"the cracker line," as it was the first time the garrison at Chattanooga was able to receive a steady supply of rations—for the Union army at Chattanooga. This action allowed the Union army to reestablish its combat strength, take the offensive, and rout the Confederates from their positions, leaving Chattanooga in the hands of the Union and the Confederate army weakened from a terrible loss.

On 20 September 1863, General William S. Rosecrans, commander of the Union forces in the West, received what would be for him a career-ending defeat at the Battle of Chickamauga. Confederate forces led by General Braxton Bragg routed the Union army when Lieutenant General James Longstreet attacked with his Corps through a gap in the Union line. Longstreet enveloped the Union line and rolled up its defense. General Rosecrans and his army were forced to retreat to Chattanooga, hoping to establish a hasty defense to stop what he was sure would be a quickly pursuing Confederate army.[1] General Bragg did not pursue the fight into the city but decided to surround Chattanooga and simply starve the Union out. Bragg had a viable plan, considering that the Confederate army controlled all the high ground surrounding the city to the south and east, and the Tennessee River served to block the Union forces in from the north and west (see map).

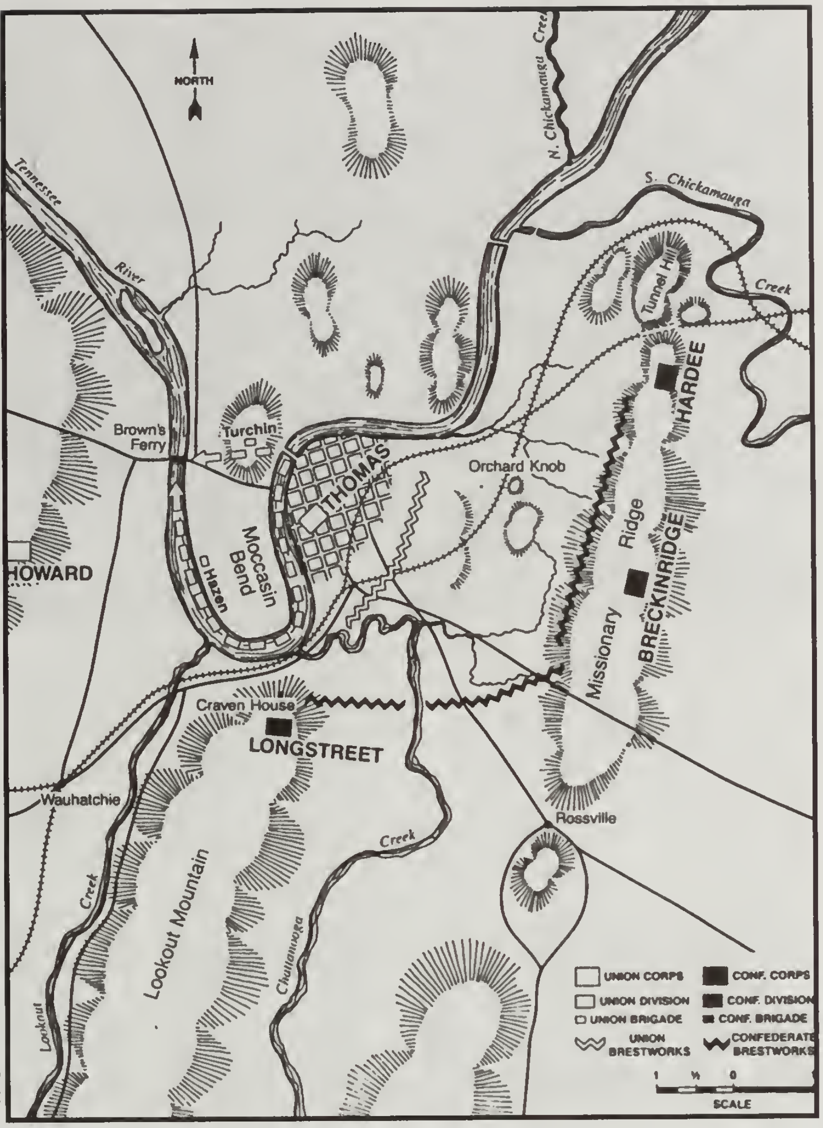
Suffering from a recent defeat and the knowledge that he had caused it, General Rosecrans lost confidence in his ability. He quickly relegated himself and his men to an eventual defeat when the Confederates decided to attack. However, weeks went by and the Confederates showed no signs of attacking.

Brigadier General William "Baldy" Smith

Rosecrans continued to improve the defense, but General Bragg's plan to starve the Union army out was starting to take effect. Surrounded on all sides by either the Confederate army or unforgiving natural obstacles, the Union army was receiving barely enough resupply to keep from starving. Supply wagons dispatched to support the Union army were subject to Confederate cavalry raids, and a treacherous route through the mountains served to destroy more of the supply wagons than did the Confederate cavalry.

The situation was desperate for the Union army at Chattanooga. The wire dispatches Rosecrans sent to Washington sounded like those of an already defeated commander; thus, President Lincoln wired General Grant and informed him either to retain Rosecrans or replace him as he saw fit. Grant immediately wired Rosecrans that he was to relinquish command to General Thomas and that he (Grant) would be arriving soon to take overall command of the situation in Chattanooga. This city was considered the gateway to the South and of extreme strategic importance to both armies.

General Grant arrived at Chattanooga on 23 October 1863 to find the Union army in a desperate situation.[2] It was secure in its fortifications within the city but, with no means of effective resupply, the army would soon starve and be virtually incapable of defending against a Confederate assault. Grant's first objective was to open an effective supply line. Brigadier General Smith offered a plan to achieve that objective. His plan called for establishing two pontoon bridges across the Tennessee River: the first would be uncomplicated; it would be positioned directly behind the city, terrain the Union controlled. The second bridge would be much more difficult, because to connect the Union to the west and its resupply, it would have to seize and bridge the area at Brown's Ferry—an area controlled by the Confederates (see map).



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Assault on Brown's Ferry (Map by J.L. Moon, Jr.)

The Union assault of Brown's Ferry began early on the morning of 27 October.[3] Smith's plan was simple and courageous and required the element of absolute surprise. Brigadier Generals John B. Turchin and William B. Hazen were assigned the infantry mission; Major John Mendenhall, commander of three batteries of artillery, was to support the infantry assault. A portion of Hazen's brigade was the main effort; the success or failure of the mission would rest largely upon its shoulders. Hazen's after-action report effectively stated the goal and method he intended to use to achieve the objectives Smith had given him:

> *"We were to organize into fifty squads of one officer and twenty-four men each, to embark on pontoon boats at Chattanooga and float down the river...a distance, by the bends of the river, of nine miles, and land upon its left bank, then occupied by the enemy, making thereafter, immediate dispositions for holding it, while the remaining portions of my brigade and another one should be speedily sent over the river in the same boats to reinforce me; the movement was to be made just before daylight..."*[4]

The other brigade Hazen referred to was Turchin's. His brigade was to move along a hidden road through Moccasin Point, take up a position directly across from Brown's Ferry, remain hidden from enemy pickets in the wood line, and wait for the assault of Hazen's brigade. Pontoon boats used by Hazen to negotiate the river would be launched to pick up Turchin's men and ferry them across to exploit the penetration of the Union line caused by Hazen's brigade. Mendenhall's artillery took up a position overlooking Brown's Ferry to support

Photo National Archives

A pontoon bridge such as this was used to bridge the Tennessee River at Chattanooga.

the withdrawal of the Union force should it become overwhelmed and find it necessary to retreat to the near shore of the Tennessee.[5]

Brigadier General Smith's plan called for a swift assault, focusing on the element of surprise to help the Union achieve victory. To achieve the element of surprise at the assault point, Brigadier General Brown decided to launch the boats well above the assault point, some nine miles by river. Smith took a tactical risk in this area stating,

> *"It was deemed better to take this risk than to launch the boats near the ferry because they would move more rapidly than intelligence could be taken by the infantry pickets and, in addition, though the enemy might be alarmed, he would not know where the landing was to be attempted and therefore could not concentrate with certainty against us."*[6]

Because the success of the mission depended largely on the element of surprise, only Grant, Smith, the brigade commanders, and the engineer officers in charge of the pontoon flotilla and the actual laying of the bridge knew the plan. The soldiers who executed the plan only knew that they were attacking the confederates and the mission was dangerous. But if the mission was successful, it would spell supplies and relief for the Union army within Chattanooga.

On 26 October at 2200 hours, Hazen's brigade marshaled at the launch site, and the soldiers were given the details of their mission. The brigade broke into fifty 25-man squads, loaded the pontoon boats, and prepared to launch the miniflotilla. The pontoons were launched at 0300 on 27 October, their movement screened by a mist that hung over the river. The soldiers were ordered to lay down in the boats. The only person exposed above the gunwales of the pontoon was the boatswain—an engineer soldier with the job of guiding the pontoon down the river. Absolutely no talking was allowed during movement.[7]

The flotilla moved silently down the river using only the current for volition. The flotilla's movement was as near to perfect as Smith could have hoped for. The boats hugged the tree-fringed banks of the river opposite the enemy. Confederate pickets spotted the boats but perceived no danger because they didn't see any men; thus, they didn't raise an alarm, assuming that the boats were merely a pontoon bridge that had been destroyed, a common site throughout the war. Only two incidents marred the boat movement: a soldier was reportedly knocked out of the boat by a tree limb but was recovered, and another soldier apparently fell out of the boat and drowned. By 0430, Turchin's soldiers were in position across from Brown's Ferry, awaiting the arrival of Hazen's men (see map, page 45). They built fires to guide the flotilla to the proper landing site and waited for the time when they would cross the river and reinforce Hazen's brigade.[8]

As the Union forces came ashore at Brown's Ferry, they surprisingly met little resistance. The only Confederate troops occupying the actual ferry site were a thin picket line that was easily routed. Behind the pickets and in a position to reinforce them, the Confederates had less than a regiment of soldiers. Had Smith's plan been executed two days earlier, an entire Confederate brigade commanded by Brigadier General Law would have met him. As it was, Hazen's brigade closed arms with the Fifteenth and Fourth Alabama of Longstreet's Corps, not nearly enough combat power to repel the Union's massed assault. Upon seizing the foothold for the farside bridgehead, the boats were sent to ferry Turchin's brigade across while Hazen's soldiers began etching out a defensive line. Colonel Oates, commander of the Fifteenth Alabama, immediately launched a counterattack against the intruding Union brigade, with the following orders, "Every man is to walk forward at one-pace intervals on a lateral line and fire only upon placing the muzzle of their weapon against the body of a Yankee soldier."[9] Though gallant, the Confederate counterattack was quickly repelled, and the Union pushed farther inland from the ferry head.

By this time, Brigadier General Turchin's brigade was quickly moving across the river. With each unit that came to the farside, the Union defensive line was pushed out farther. Brigadier General Smith ordered an abatis placed around the perimeter of the Union bridgehead to establish a hasty defensive position and provide cover from Confederate muskets. Colonel Oates continued to attempt counterattacks throughout the morning until he was wounded. Later that day, Brigadier General Law arrived with three more regiments and a regiment of the Texas Brigade to find Oates in a nearby farm house, recovering from a wound.

Oates informed Law that he had arrived too late to make a difference. The Union had managed to cross a sizeable force and had gained a very tenable position. Law went forward to a vantage point from which he could oversee the Union position. With one look, he turned around, returned to Colonel Oates, and remarked that Oates was quite correct in his assessment. By that time, 1630 hours, the Union had seized the bridgehead and emplaced the pontoon bridge (see map, page 45), thus creating the Union's cracker line. This one small action was the beginning of the end for the Confederates at Chattanooga.[10]

Establishing the cracker line enabled the Union to effectively resupply its garrison in Chattanooga—not only with food and ammunition but also with troops. Opening this supply line coincided with two other events. First, Longstreet's Corps departed from the Confederate perimeter to attack Major General Burnside's Union force at Knoxville. Second, Major General Sherman's army arrived to reinforce Grant at Chattanooga. The result was a reinforced Union army and a weakened Confederate force. The ability to resupply the Union force at Chattanooga hinged completely on Brigadier General Smith opening the cracker line. Establishing the bridge across the Tennessee River was arguably the decisive point of the battle of Chattanooga for the Union army.

* * *

Brigadier General Smith expertly employed the principles of a river crossing to emplace a pontoon bridge across the Tennessee River and establish a supply route for the Union forces at Chattanooga.

Advance to the river, phase one, requires a unit to seize the terrain on the nearside of the river, including road networks and favorable crossing sites. Smith moved Turchin's brigade to the nearside of Brown's Ferry, a site that obviously had a trafficable road network and a preconditioned crossing site. This move ensured that Hazen's assault force would have a reserve and that the assault force would not arrive at Brown's Ferry to find the Confederates already occupying the nearshore and, thus, become flanked.

Assault across the river, phase two, is designed to place combat power rapidly on the far shore to eliminate the enemy's ability to place direct fire on the crossing site and secure terrain for attack positions. Smith executed this phase perhaps better than any other portion of the operation. Using the principle of surprise, he massed a large force on the far shore rapidly and with little resistance by the Confederate army. Brigadier General Smith made it impossible for the Confederates to place direct fire on the bridge site, which allowed him to cross Turchin's brigade.

Advance from the exit bank, phase three, is intended to extend the initial foothold created by the assault force. Once Turchin's brigade crossed, Smith pushed the bridgehead line out farther—known today as seizure of an intermediate objective. The intent is to prevent direct fire from being placed on the bridge site and to deny observation of indirect fire. By pushing his lines out farther into the enemy-controlled area of the bridgehead, Smith negated the enemy's ability to see the river-crossing site. This allowed Smith to begin emplacing the pontoon bridge and prepare for the crossing of even larger units to secure the foothold created by the initial assault.

Secure the bridgehead, the final phase, is designed to create a position secure from enemy counterattack and large enough to accommodate follow-on forces as they cross the bridge. When Smith ordered the felling of an abatis and established his initial defensive perimeter, he effectively repelled at least four counterattacks by Colonel Oates and his Alabama brigades. When Brigadier General Law and Confederate reinforcements arrived, Smith's position was immovable by the available Confederate forces; by 1630 hours, the bridge was emplaced. Smith's two brigades now held a very tenable position, and the Union supply line to Chattanooga was open.

* * *

Captain Place currently commands A Company, 326th Engineer Battalion, 101st Airborne Division (AASLT), Fort Campbell, Kentucky.

Endnotes:

[1] James Lee McDonough, *Chattanooga-Death Grip on the Confederacy*, Knoxville: University of Tennessee Press, 1997, p 8.

[2] Ibid, p. 54.

[3] Ibid, p. 76.

[4] United States War Department, *War of the Rebellion: Official Records of the Union and Confederate Armies*, Series 1, Volume 31, Part II Reports: *Lookout Mountain and Missionary Ridge*, Harrisburg: Historical Times Inc., 1985.

[5] Ibid.

[6] Ibid.

[7] McDonough, p. 79.

[8] Ibid.

[9] United States War Department.

[10] McDonough.

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Professional Registration: Advice for Aspiring Army Engineers

By Captain Richard J. Gash

Almost two years ago, a group of Engineer Officer Advanced Course (EOAC) classmates and I struggled through the professional engineer (PE) application process. After hours of toiling over experience forms, making innumerable telephone calls to the Missouri Board for Professional Engineers, and spending a small fortune on express mail, some of us met the application deadline. Many did not.

The purpose of this article is to capture the lessons we learned while applying and share them with engineer officers aspiring to do the same. In keeping with most military operations, I have broken the process into four phases. The first phase involves becoming an engineer in training, which is designed to set up an applicant for success. The second phase is filling out the application. The third phase, which is generally everyone's favorite, is studying and preparing for the exam. The final phase is taking the examination.

Phase I: Engineer in Training

This phase begins before commissioning and continues through the Engineer Officer Basic Course (EOBC) and assignments leading up to the EOAC. The first step is to become an engineer in training by graduating from an engineering program approved by the Accreditation Board for Engineering and Technology and passing the Fundamentals of Engineering Examination. This requirement is written in Missouri law. The second step is EOBC. My advice for the course is threefold. First, pay attention. Second, keep the construction handouts. Third, start a professional journal. While it may be possible to succeed without the first two pieces of advicc, the journal is essential.

Engineer's Creed

As a professional engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare. I pledge—

- To give the utmost of performance.
- To participate in none but honest enterprise.
- To live and work according to the laws of man and the highest standards of professional conduct.
- To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with need for divine guidance, I make this pledge.

Your professional journal should include a record of all the engineering-related projects you work on. The EOBC practical exercises are a great place to start. This record will make filling out the experience portion of the PE application much easier. Another important aspect of the journal is contact information. The application requires the officer who was your supervisor at the time to verify your engineering work experience. While at EOBC, get a good permanent standard or e-mail address from your platoon trainer and company commander. You will have to mail one of them a part of your application for signature four years later. Your journal should also include contact information for PEs you work under. You will need recommendations from three of them for the application. If anyone in your EOBC chain of command—from platoon trainer to brigade commander to course director—is a PE, introduce yourself, state your intentions, and get good contact information.

Phase I continues with the jobs you hold as a lieutenant. Keep updating your journal with contact information for PEs and supervisors. Continue to record engineering projects you work on. While some of us are lucky enough to work in construction units or even for the U.S. Army Corps of Engineers, most of us are more familiar with concertina wire and C-4 than construction. *This is not a problem.* Believe it or not, much of the work done by mechanized and light engineers *is* engineering related. Route, bridge, and ford reconnaissance; bridge classification and demolition; terrain and trafficability analysis; and even combat obstacle and fighting position construction all require engineering and project-management skills. Record them in your journal. Always fight to get projects that will add to your experience. A combat engineer platoon can easily clear and construct a live-fire range or even a playground!

Phase I culminates with the transition to EOAC and the start of the application process for the Principles and Practice of Engineering Examination. Fortunately for most engineer officers, the engineer-in-training experience required to apply generally coincides with the move to Fort Leonard Wood, Missouri. The end state for this phase is four years of experience and good contact information for supervisors and PEs. If your experience doesn't quite add up to four years, don't panic; EOAC and postgraduate education (University of Missouri–Rolla) will add to your time.

Phase II: Application

The application to take the Principles and Practice of Engineering Examination is probably the biggest obstacle separating Army engineers from professional registration. Timing, perceived lack of engineering experience, and the inability to obtain signatures combine to discourage many officers from applying. Selecting the proper exam date and completing the application early will give you the best chance for success.

The Missouri Board for Architects, Professional Engineers, and Professional Land Surveyors and Landscape Architects administers the examination semiannually in April and October. I recommend taking it right after graduation from EOAC. Although it is tough to juggle course requirements, studying, and trips to the Lake of the Ozarks, staying on for the University of Missouri–Rolla degree will give you a chance to take the exam a second time in Missouri if you fail. Get an application from the Missouri Board as soon as you begin EOAC. You can request one through the board's Web site at *http://www.ecodev.state.mo.us/pr/moapels/*. Even though applications are generally due three months before each examination, complete yours as soon as possible and turn it in early. If the board finds any problems with it, you will have time to correct it. I found the board very willing to help.

The two sections of the application that cause the most headaches are Section V, *References*, and Section VI, *Engineering Experience*. Section V requires applicants to obtain character recommendations from five individuals, three of whom must be PEs. I strongly advise sending out additional recommendation requests. Since military life is transient by nature, at least one of the officers on whom you were banking will be deployed to a classified location, in the middle of a PCS, or will simply not receive your request. The recommendation form is easy to fill out. A couple of completed extras will ensure that you do not get caught short. It is also very likely that you have been out of contact with many of your potential references for some time. Your EOBC brigade commander or former college professor may not remember who you are. If you fear this may be the case, include a copy of Section VI from your application and the telephone number of your last battalion commander for them to contact.

An early start should allow you plenty of time to get the recommendations you need. However, if you find yourself closing in on the application deadline and still in need of recommendations, there is one last course of action available. Start knocking on doors at the U.S. Army Maneuver Support Center at Fort Leonard Wood. Because it is the home of the U.S. Army Engineer School, it has one of the highest concentrations of PEs in the Army. With a proper introduction and the right testimonials, you should find the recommendations you need. *(Note: The Engineer School point of contact shown in the figure on page 50 maintains a list of PEs on post.)*

Section VI is the meat of the application. In it you must account for four years of engineering experience—all accrued subsequent to baccalaureate graduation. Here is where the experience part of your professional journal will come in handy. The application requires a brief synopsis of the work you have done in each job you have held. A supervisor who oversaw your work must verify each synopsis with his or her signature. Although the application appears to imply that this supervisor must be a PE, this is not the case. Keep in mind that you cannot use the same person as a supervisor and as a reference. Remember to include EOBC and EOAC as part of your experience. *(Note: The Engineer School point of contact has examples that might be helpful.)*

If you have any questions while working on your application, the best thing to do is contact the board or the Engineer School point of contact. The end state for this phase is an accepted application and a letter from the Missouri Board authorizing you a seat at the examination. Once you have this letter in hand, it is time to focus all your energy on studying and Phase III.

Phase III: Preparation

The question of how much effort to put into studying for the Principles and Practice of Engineering Examination is foremost on every applicant's mind. The best answer—although probably not the one you want to hear—is, of course, enough to ensure that you pass! This can range anywhere from a few weeks to a few years. Each applicant should conduct an introspective assessment to determine how long and how hard he needs to study. I recommend erring toward longer and harder. It is important to note that for many, this period of preparation may need to start well before Phase II is completed.

The next questions most applicants have are what and how to study. Fortunately, I can offer much more explicit advice in this area. Concerning what to study, I strongly recommend that civil engineering applicants purchase Michael R. Lindeburg's *Civil Engineering Reference Manual, Practice Problems for the Civil Engineering PE Examination,* and *Civil Engineering Sample Examination*. Used together, these three books will serve as excellent study guides. They will also function as invaluable resources during the examination. The reference manual contains detailed information about the examination, step-by-step sample problems, and a wealth of up-to-date reference material. The practice problems book includes sample problems covering engineering fundamentals and all disciplines of civil engineering. The sample examination offers a great way to gauge the progress of your preparation. All three books are well worth the cost.

How to study is a little more complicated. It is best to develop a solid plan of action that will streamline your preparation process. A good place to start is by researching the examination, which recently underwent significant revision. The new civil engineering exam format has two sessions. The morning session includes 40 multiple-choice questions that encompass all disciplines of civil engineering. The afternoon session also has 40 multiple-choice questions focused on one of five disciplines. Applicants must choose from water resource, transportation, geotechnical, environmental, and structural engineering. Decide on a discipline early in your preparation, and focus your studying on that field.

After selecting an area of emphasis, the best way I found to study was to work through the practice problems in Michael

Lindeburg's books. The first section in the reference manual is devoted to engineering fundamentals. Although these may seem rudimentary at first, I found them invaluable as a review of complex unit conversions and how to use my calculator. Mastering these two areas alone will greatly enhance your chances for success on the examination. The next sections are each devoted to one of the five afternoon disciplines. Don't be disheartened by the difficulty of the sample problems. With practice, answers will begin to come easily.

While you work through sample problems, take time to become familiar with your reference materials. Chances are that you have the information needed to answer all of the examination questions somewhere in your references. The trick is being able to find the right information quickly. Try to avoid always looking for answers in Michael Lindeburg's books. One slight flaw with using them as study guides is that by design, almost all the information needed to solve his sample problems can be found somewhere in his reference manual. Some of the actual exam questions may require you to dig through other references. You need to become familiar with your other manuals as well.

As examination time draws near, I recommend taking a break from studying. Take some time to relax and mentally recharge. You definitely do not want to be burned out before starting the eight-hour exam. Take the last few days to finish organizing your references and supplies and make the transition from Phase III to Phase IV. The end state for this phase is the confidence that you are ready to pass the examination.

Phase IV: Examination

Taking the Principles and Practice of Engineering Examination is the last step in the process of becoming a registered PE. This phase involves actions on the objective. I can offer advice on what to bring with you, along with some final hints. Taking the examination is up to you!

Applicants often lose sleep while trying to determine which reference books to take to the exam and which to leave behind. I can clear up any confusion. If in doubt, take it. Take every book you own that remotely relates to engineering. Go to the Maneuver Support Center library and check out any additional books you think you might need. Take a good dictionary, the thicker the better. Inevitably, questions will include obscure words you have never seen before. Take your Engineer School handouts. They present a surprising amount of pertinent information in an easy-to-follow format. Don't worry about being overloaded. No matter how many books you take, you will see people at the exam with more. It is easy to tell the first-timers from the veterans of several examinations. The novices struggle from their cars to the exam room, dropping books out of overflowing cardboard boxes. The veterans have bookshelves on wheels they can push along with them. I recommend the middle ground—a collapsible luggage dolly.

In addition to your reference materials, make sure you think through the logistics involved in taking the exam. You will need a good transportation plan. This is partly to accommodate your reference materials, but mostly because of the road network in central Missouri. The board makes every effort to centralize the exam location for applicants from across the state. Unfortunately, this ensures that a direct land route will not exist between the exam site and Fort Leonard Wood. Take the time to conduct a good route recon before the examination. Struggling down unfamiliar Ozark roads in the predawn darkness will only add unneeded stress to your day. A better plan would be to spend the night before the examination in a local hotel so you won't have to worry about getting to the examination site on time.

Becoming a Professional Engineer

The licensure of PEs is important to the public because of the significant role engineering plays in society. The profession regulates itself by setting high standards to help protect the public safety and welfare. Becoming registered as a PE increases your opportunity for promotions, pay raises, credibility, respect, and security.

The U.S. Army Engineer School maintains a Web site at *www.wood.army.mil/ENGR/register.htm* that provides general information about registering military personnel as PEs.

The registration process involves the following steps:

- Graduate from an Accreditation Board for Engineering and Technology accredited program.
- Pass the Fundamentals of Engineering Examination.
- Gain a minimum of four years (three years with a master's) of verified practical engineering experience.
- Pass the Principles and Practice of Engineering Examination.

Examinations are typically administered twice a year, once in April and once in October. Applications must be completed 45 to 120 days before the examination date, depending on the individual state regulations.

The Engineer School point of contact for questions pertaining to the PE registration process is Mr. Kenny Light, PE, at *lightk@wood.army.mil.*

Having the proper amount of supplies is also essential to success. Determine how many pencils, erasers, batteries, and even calculators you think you will need—and double that amount. Halfway through the afternoon session is not the best time to realize that the "7" key on your calculator has stopped working.

My final piece of advice is to stay relaxed. Don't panic or get frustrated. Stick to your plan of action. Don't try to switch afternoon disciplines at the last minute just because you overheard someone during lunch saying that transportation was easier than water resources. Trust your preparation. Keep a positive attitude. The end state for this phase is walking out of the exam site with full confidence that you passed!

Captain Gash commands the Headquarters and Support Company, 864th Engineer Battalion, Fort Lewis, Washington. Previous assignments include plans officer for DCSPER, I Corps, Fort Lewis, and mechanized engineer platoon leader and company executive officer, 70th Engineer Battalion, 3d Brigade, 1st Armored Division, Fort Riley, Kansas. CPT Gash is a graduate of the United States Military Academy and the Engineer Officer Advanced Course and holds a master's in geology and geophysics from the University of Missouri-Rolla. He is a professional engineer in Missouri.

Developing an Engineer Exit Strategy for Road Repair and Maintenance

A Roadmap for Returning Responsibilities Back to the Host Nation in Bosnia-Herzegovina

By Colonel Michael J. Ulekowski

As the number of peacekeeping missions increases, countries involved with these missions look for a means to decrease their engineer forces within that country and return the responsibility for road repair and maintenance back to the government entities that were initially responsible for them. This becomes much more important as the costs for the military presence increase over time and the total numbers of military forces within countries involved with peacekeeping are decreased with the lessening of Cold War tensions.

Initial Engineer Mission

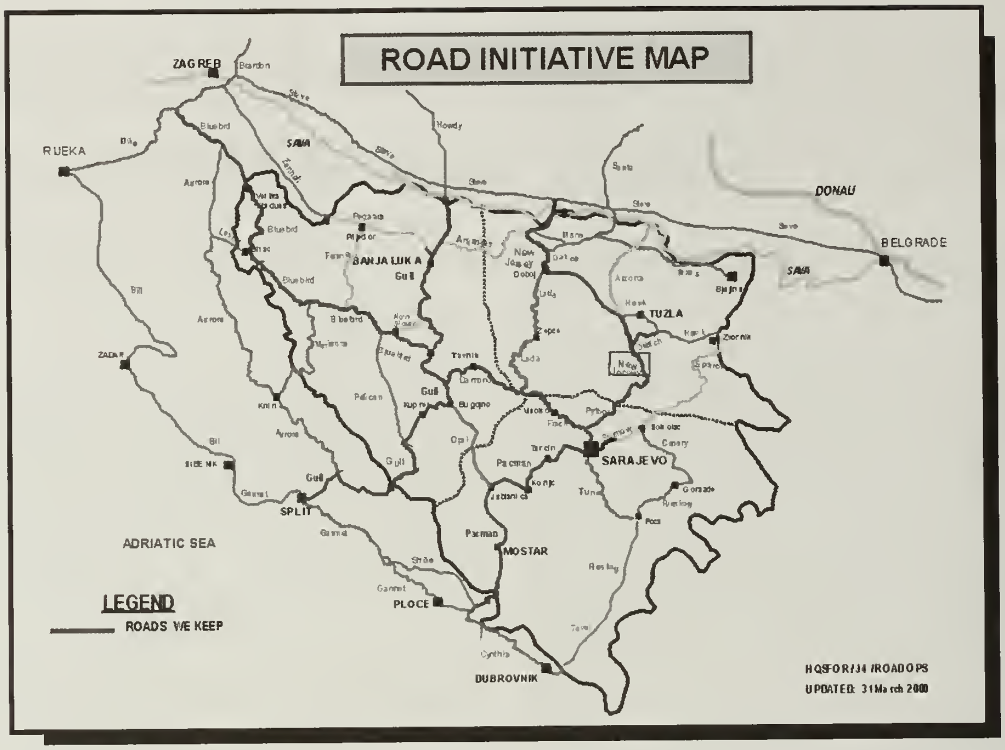
When initial forces arrive in a host country with the intention of being peacekeepers, the immediate mission is for control of the country. For engineers, this means a return of freedom of movement—primarily road and rail—for the incoming troops. Host nation government involvement in this phase is either very minimal or nonexistent. Engineer troops are brought into the country in sufficient numbers to perform temporary repair and minimal maintenance. The standard at this point of the mission is the minimum military requirement, which is normally marked by the ability of the roadway to handle a military four-wheel-drive vehicle. There is no contingent for providing a means for civilian traffic to move on the roadway.

Bridge repair is accomplished through the use of temporary military bridges, such as the Mabey Johnson or Bailey truss bridge. These bridges are not designed to be permanent structures, nor are they designed for heavy civilian traffic. During this time, only major roads—which include those designated as main supply routes or theater-controlled roads—are opened. All others are either ignored by the peacekeeping forces or left to subordinate unit control.

The initial return to normalcy is marked by direct contracts between the peacekeeping force contracting agency and civilian contractors for road repair and maintenance. Normally, governments are not in this loop since they are still in the process of recovering. Also, it is easier and faster to work directly with the contractors.

Unfortunately, during this period, there is no incentive for the government agencies to develop ethical procedures in dealing with contractors and outside agencies providing money for roads. As a result, previous procedures that were not up to U.S.-acceptable ethical and moral standards continue to flourish. With the concentration of international money coming into the country and the desire of government agencies for this cash flow, the situation can easily develop into one of government corruption and mismanagement.

Route Sparrow in Bosnia, March 2000. Some of the results from improper road construction by the old Yugoslavian government were spectacular in their failures. Using the MOU and the oversight by SFOR engineers, the reconstruction will follow more on Western European guidelines, keeping these roads from failing.



For the initial MOU with the Federation of Bosnia-Herzegovina and the Republic of Srpska, certain roads remained under SFOR control for maintenance and repair. All other roads were considered part of the joint venture initiative in March 2000.

Engineer Operation in Bosnia-Herzegovina

With the breakup of the former Yugoslavia, numerous wars erupted within the fragments of that country during the 1990s. A group of nations led by NATO entered Bosnia-Herzegovina following the failure of the United Nations Protective Force to keep the peace. As time progressed, a strategy was developed to reduce the engineer mission within that country and bring about a return to normalcy for the government agencies responsible for road repair and maintenance.

During the three years that the warring factions fought each other in Bosnia-Herzegovina, much of the national infrastructure was destroyed. When the Implementation Force (IFOR) moved into the country in 1995, the primary mission of the engineers was to regain freedom of movement. When IFOR became the Stabilization Force (SFOR) on 20 December 1996, military forces—especially engineers—were decreased by the participating nations. This decrease occurred deliberately and rapidly, especially after commitment of troops to Kosovo.

Government Structure

Within Bosnia-Herzegovina, two different governments were set up: the Federation of Bosnia-Herzegovina and the Republic of Srpska.

Federation of Bosnia-Herzegovina

The Federation, which consisted of Bosnian Croats and the Muslims (later known as Bosniacs), was formed from two entities within the government structure that had previously fought with each other. Politics and a lack of desire for true unity further complicated issues.

The Federation's road directorate was responsible for road maintenance and repair. Under the former communist system, there was no free enterprise used in contracting for roadwork. Instead, each area had Putevies (the Yugoslavian term for contractors), who were completely responsible for certain roads. There was no open bidding or competition for the work. Since only one contractor was responsible for an area's road network, the quality of construction varied from area to area.

Many of the records for road and bridge construction had been destroyed during the war, making it difficult to engineer good renovations or replacements. However, with the capital of the Federation residing in Sarajevo, the government agencies were able to use old government offices and facilities that weren't destroyed in the war to make their return to normalcy more efficient. The few records that survived were in these facilities, making it easier on the new government road directorate.

Republic of Srpska

The Republic of Srpska government consisted of Bosnian Serbs. Even though this portion of Bosnia-Herzegovina had no problem with internal politics, the posturing of the government during the initial days of the peacekeeping mission—and its inability to work with IFOR—resulted in minimal funds from international sources. With little money to perform the needed repairs, the roads suffered. Since government offices were needed that did not exist before the war, money was used to develop these offices rather than for other purposes that would have helped with the civilian freedom of movement. An open government hostility to the United Nations and peacekeeping missions also resulted in a more difficult situation for the road directorate in dealing with the external forces within its boundaries. As the government matured, this hostility became less of a problem and international money previously withheld became available to the Republic of Srpska. Again, the former communist system did not provide for open competition and hiring of the best available contractor for roadwork.

Snow and Ice Clearance Operations

In 1997, military snow removal assets were reduced in Bosnia-Herzegovina, requiring an alternative method for removing snow and ice from the national road system. SFOR headquarters also decided to increase the number of roads cleared during the winter months. The result was that SFOR contracted with 13 different snow and ice clearance contractors for plowing the roads. The military regional engineer offices (part of SFOR) were insufficient to ensure that contractors were performing properly. Both Bosnia-Herzegovina governments were unwilling to help enforce the contracts since the contractors reported directly to SFOR. Clearing of ice and snow that winter became an unenforceable nightmare.

Memorandum of Understanding

In 1998, a memorandum of understanding (MOU) was set up through each of the two government road directorates so that they would receive payment from SFOR to contract directly with the snow and ice clearance contractors. This allowed SFOR to use the government entities to enforce proper performance of the contractors. It also provided a means for money to flow through the government agencies, giving them credibility as well as a certain amount of cash flow. Of course, because of the situation, the MOU included penalties for not performing to a given set of standards and also for not paying the contractors, a problem that was prevalent during the beginning of the season. Because of the success of these contracts in both 1998 and 1999, a decision was made within SFOR to use this method of returning more of the responsibility for road maintenance and repair back to the Bosnia-Herzegovina governments.

The Road Initiative

In the summer of 1999, SFOR military assets funded the maintenance of 2,300 kilometers of roadway, while an additional 3,300 kilometers were the responsibility of the divisions within SFOR. In January 2000, MOUs were developed for execution with both road directorates for future road maintenance and repair projects. Because of the experimental nature of this initiative, certain roads were kept under the old system of complete SFOR responsibility, specifically two major east-west roads and two major north-south roads. The majority of other road maintenance was to be accomplished through joint ventures between SFOR and the road directorates.

A list of possible joint venture projects was developed twice a year, or when warranted by changes in the road conditions, by both SFOR and the road directorates. Both must approve each project for joint venture. Naturally, if each of these organizations thought that a project was important enough to fund completely through its own resources, this was acceptable. However, for the first series of projects, SFOR would fund 50 percent of each with the remainder funded by the respective government.

SFOR stipulated in the MOU that only preapproved contractors would be allowed to bid on the roadwork. Also, contractors would be allowed to bid on any road repair projects, even those that previously had been the responsibility of another contractor in the old Yugoslavian system. Because NATO is the primary funding agency for SFOR, NATO contracting procedures apply to the invitation for bid and the contract execution process. This brought more of a western approach to the construction contracting process through the governments.

SFOR freedom of movement engineer teams that had replaced the previous regional engineers were responsible for random quality assurance inspections. The road directorates were responsible for selecting the contractors and maintaining the contracts with them. The directorates were also responsible for providing joint supervision of the construction work, ensuring proper completion and a quality of work that was comparable to SFOR and NATO specifications. Payment from SFOR was scheduled at the end of the project, following a "joint declaration of acceptance of the works." For long, expensive projects, partial payments could also be agreed to on a case-by-case basis.

Both governments agreed to the wording of the MOUs in May 2000. The initial percentage of SFOR participation in the funding process was set at 50 percent. As civilian traffic increased and SFOR traffic decreased, the percentage of the total amount paid to the governments for the projects would decrease. This decrease was planned to correlate to the amount of SFOR traffic on the roadways, according to a survey jointly conducted by SFOR and the governments. As time passed, SFOR would become more of an investor in the roadway system of Bosnia-Herzegovina than an implementer of the construction work. There are also provisions in the MOU for modifications as the road situation changes. All roads are reviewed annually on 15 March, which provides a means of adding or subtracting more roads to the MOU, depending on the current situation.

Importance of an Engineer Presence

An important factor in this process was the presence of a civilian engineer assigned to SFOR who kept the process on track through the rotations of chief

(continued on page 57)

Let's Get Our Volcano Systems Into the Fight

By Colonel Thomas K. Littlefield, Jr. (Retired)

As a silver-dollar-sized drop of semifrozen rain found its way down the back of his neck, Captain Buck Rogers noted that the weather was just about as miserable as it could possibly be. It had been a long, cold night for his Ruff Riders, a company of 135 of America's finest young warriors. They were in a defensive position in Orangeland, as part of the new, elite Early-Entry Deployment Force (EEDF). A brigade-sized unit that's part of the newly formed Joint Reaction Force, the EEDF was the most modern, high-speed unit in the U.S. military. The Ruff Riders had been training for the past six months and had three more months scheduled when this crisis erupted. It didn't matter what the training status was; Captain Rogers knew that you go when you're called. Until three days ago, he and most of his soldiers had never heard of Orangeland. He just wished he had more time to work out the details of employing the new joint standoff weapon systems.

Another challenge not seen in the train-up was the failure of the situational-awareness system. The NCOIC said that something was wrong with the satellite, so the company set up local repeaters. Two of the five sites had been overrun the first night. Thirty of Rogers' 135 warriors had been detached to protect one of the remaining sites.

Captain Rogers was finally able to slip away for some sleep. With all that was going on, he hadn't slept in more than 72 hours. Almost, it seemed, before he closed his eyes, he was roughly shaken awake. It was the first sergeant, who reported some activity on the southern side of their position. Rogers gave orders for Situation Charlie—Ruff Rider talk for 100 percent security—and to lock and load all systems. Local sensors identified a number of dismounts and 15 vehicles approaching. They were represented by red icons, so they had to be the enemy.

Captain Rogers directed that the new standoff antitank weapons engage the vehicles and the new standoff antipersonnel systems engage the dismounts. The system operators pushed their "execute" buttons and received a "Code 6" error. This meant that a commander higher in the chain of command had overridden his systems with a nonengagement order. He called his next higher commander—the brigade commander—who said that he had no enemy showing on his display; thus, he hadn't released engagement authority. After a heated discussion, the brigade commander said he would contact the corps for guidance. The corps commander was adamant that he couldn't release engagement authority. His information flow and display showed no enemy anywhere near the Ruff Riders.

As the brigade commander attempted to get engagement authority from the corps, Captain Rogers rushed to assess the developing situation on the southern part of his position. By the sounds of it—a crescendo of small arms with machine guns, mortars, and an occasional main gun—Rogers figured he was getting hit by a company-sized unit supported by up to 15 tanks. Tanks hadn't shown up on his order-of-battle display. He guessed that they didn't show up on the brigade or corps commander's display either. The standoff fight never occurred; close combat was the order of the day.

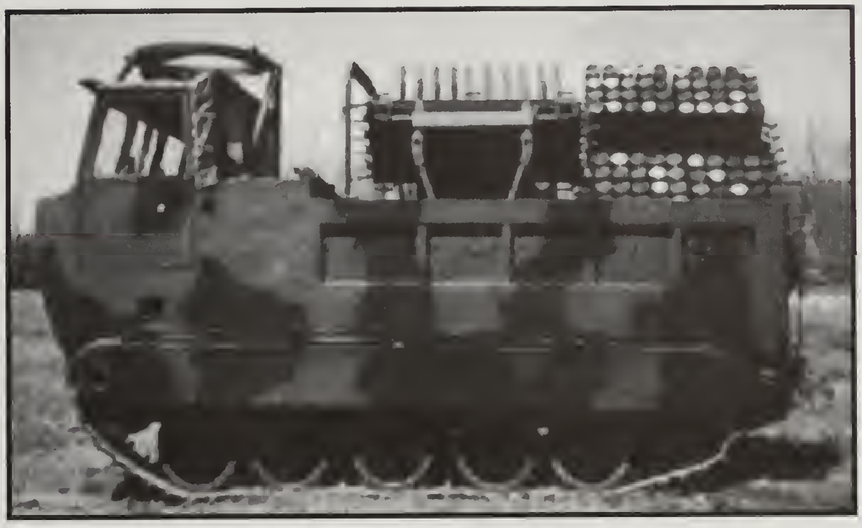
* * *

This scenario may sound outlandish, but we have the same problem today. Higher commanders are the emplacement authority for the scatterable mine systems in our inventory. According to FM 20-32, *Mine/Countermine Operations*, obstacle emplacement authority is the jurisdiction that a unit commander has to emplace tactical obstacles. In a theater of operations, theater commanders have the authority to emplace obstacles. In most cases, they delegate this authority to corps commanders, who further delegate it to division commanders. Division commanders then have obstacle emplacement authority in their area of operations, unless authority is withheld or restricted by a higher commander. Commanders subordinate to the corps and division do not have the authority to emplace obstacles unless the higher commander delegates authority for a current operation.

During my time as a combat engineer commander and staff member, I had difficulty in getting authority for using our organic Volcano systems. Often we could get authority for 4-hour-duration mines. The problem came when we requested 48-hour- or 15-day-duration mines. I occasionally received 48-hour permission, but I never received 15-day permission. At the same time, I had permission to emplace conventional hand-emplaced mines that didn't have a self-destruct capability. They are armed and deadly until removed or destroyed.

Why will permission to use a temporary mine be denied while permission to use a permanent mine be routinely allowed? The usual reasons that I received for denial were concerns about fratricide and constraints on future maneuverability. Both of these concerns can be mitigated. Before any land Volcano system can be used to emplace a minefield, fratricide fences must be erected, just like those used for conventional hand-emplaced minefields. The concern about future maneuverability can be mitigated with the use of lanes, which can be left in the Volcano minefield. They can be closed with Modular Pack Mine Systems (MOPMSs). They can also be opened with the self-destruct feature of the MOPMS.

As we move to the future, we have to get used to replacing conventional hand-emplaced mines with scatterable mines. We need to do this for three primary reasons: much reduced logistical requirements, much faster emplacement times, and much smaller manpower requirements. In the logistical arena, a Volcano antitank mine weighs about 4 pounds versus about 30 pounds for a conventional M15 antitank mine. This is more than an 85 percent reduction in weight for countermobility logistical requirements. Two soldiers with one vehicle can emplace a 1,000-meter minefield in about 10 minutes versus the 10 hours it takes an engineer platoon to emplace a surface-laid conventional minefield of the same length. This is extremely significant when you consider the significant reduction of sappers in combat engineer companies.



A Volcano system mounted on an M548A1 tracked cargo carrier

As a company commander, my company had nine 10-man sapper squads. As a brigade commander, my companies had six 8-man squads. The last version of future divisional engineer companies that I saw had four 8-man squads. We have a reduction from 90 sappers to 32 in combat engineer companies. This greatly reduces the ability to hand-emplace mines in a time-constrained situation. We have to depend on scatterable mines emplaced by the Volcano system.

We need to routinely use the Volcano as we would conventional mines. We need to let people know it's all right to use them in the 15-day mode if the situation dictates. I found that the brigade commanders I supported didn't routinely plan 15-day Volcano minefields, because they couldn't count on getting the required authority. Instead their fallback/default was to depend on conventional mines.

We have an Army based on decentralized mission command, but we routinely restrict the use of the Volcano. The same commanders who impose these restrictions don't think twice about delegating conventional mine-emplacement authority to the battalion level. What's wrong with this picture? They are very concerned about scatterable mines that will never last longer than 15 days but will use conventional mines that last for years without a second thought.

My message to commanders is this: Don't tie the hands of subordinate commanders. Don't routinely withhold authority for using the Volcano. Only withhold the authority as you would for conventional mines. Don't restrict commanders from bringing all their combat multiplier systems into the fight. Let your commanders know what their Volcano assets are and allow them to use these assets. Use specific and not blanket restrictions. A commander would never assign a defend-in-sector mission to a subordinate commander and withhold the use of organic weapons. They need to do the same for the Volcano. If not, this valuable tool will never be used to its potential to make up for the lack of sapper manpower and reduce the logistical requirement for tactical obstacles.

I recommend the following to commanders:

- Use specific obstacle restrictions for specific reasons rather than simply using blanket restrictions because "that's the way we've always done it" or "that's the way we did it at NTC."
- Allow people on the ground to determine the best way to fight their ground, especially if they are assigned a defend-in-sector mission.
- Use the Volcano to make up for reduced sapper manpower, provide faster obstacle emplacement, and reduce the obstacle logistics.
- Develop unit rapid mine teams and drills using the Volcano.
- Mitigate fratricide concerns with fratricide fences.
- Mitigate future maneuverability concerns with lanes and closure with the MOPMS.

Appropriate use of the Volcano system won't get better until maneuver commanders demand it. Plan it, and do it. Don't stand for being limited any more than you would with your main weapon systems.

Colonel Littlefield (now retired) was assigned to the U.S. Army War College Department of Military Strategy, Planning, and Operations when he wrote this article. He previously commanded the 2d Infantry Division's Engineer Brigade. A graduate of the United States Military Academy, COL Littlefield holds a master's in operations research/systems analysis from the Naval Postgraduate School. He was a joint specialty officer and is a registered professional engineer in Virginia. He is now a contractor for Sonalysts, Inc., working in joint experimentation.

Note: A variation of this article was published in the Spring 2002 issue of *Infantry*.

CTC Notes

Joint Readiness Training Center

Mobility/Countermobility/Survivability Battlefield Operating System Needs Emphasis (4th Quarter 2002)

By Captain James C. Moses

TREND 1

Subject: **Troop-Leading Procedures (TLPs)**

Observation: **Detailed TLPs are inconsistent at the platoon level.**

Discussion*:* After receiving the task force order and subsequent fragmentary order (FRAGO), the platoon does little analysis before issuing its own FRAGO. Similar actions are taken at the squad level, resulting in ill-prepared soldiers to execute the mission. Detailed backward planning would help establish a timeline for the platoon leadership to follow. The absence of any engineer battlefield assessment (EBA) leads to hasty plans with noticeable gaps. Most FRAGOs lack sufficient detail in the situation paragraph and also fail to address branches and sequels adequately. Too often, platoons conduct no rehearsals. Precombat checks (PCCs), precombat inspections (PCIs), and squad rehearsals are essential for mission success. This will require extensive involvement by the platoon sergeant and platoon leader. The last step of TLPs—supervise—also requires attention. Officers and NCOs must get involved and supervise their soldiers to ensure mission success. The absence of detailed TLPs causes soldiers to be unsure of their specific requirements during movements, reconnaissance missions, and clearance operations.

Reference: ARTEP 5-145-11-MTP, 05-3-1018, *Mission Training Plan for the Combat Engineer Platoon, Heavy Division/Corps/Armored Cavalry Regiment.*

Techniques and Procedures: Continue to refine the TLP process within the platoon so that leaders are adequately involved in both planning and execution to achieve not only mission success but also the highest possible standard. Mission analysis begins immediately after developing facts and assumptions from the received mission statement. Efforts should be made to assign mission warning orders to platoons, a minimum of 24 to 48 hours out, to allow for effective TLPs. If this time frame is not available, it should begin immediately upon receipt of the mission. Ensure that squads are doing complete orders and that brief backs are conducted at all levels, to include squad leaders to platoon leader and platoon leader to commander.

TREND 2

Subject: **Combined-Arms Rehearsals**

Observation: **Platoons rarely conduct rehearsals to validate battle drills, standard operating procedures (SOPs), or plans.**

Discussion*:* We often do not see productive combined-arms rehearsals during mission preparation at any level. Rehearsals for breaching and obstacle reduction are critical for mission success. There are many situations that require rehearsals and sufficient time to conduct them. Rehearsals are also a means of refining PCC and PCI checklists. Oftentimes, mission execution is slow or incomplete for reasons that could have been identified and corrected by proper rehearsals. Rehearsals should cover planned operations as well as contingencies. Battle drills and recurring tasks, such as casualty evacuation, should be rehearsed periodically.

Techniques and Procedures: Adequate time needs to be programmed into the timeline to allow for combined-arms rehearsals. Analyze the situation to prioritize the appropriate rehearsal type and technique. The more detailed the rehearsal, the greater the understanding the soldiers will have. Leaders at all levels need to ensure that once time is allocated, full-dress combined-arms rehearsals will take place and cover actions on the objective and contact contingencies. For information on the different types of—and techniques for—rehearsals and obstacle reduction, refer to FM 3-34.2, *Combined Arms Breaching Operations*, Chapter 4 and Appendix C.

TREND 3

Subject: **Battle Tracking**

Observation: **Platoons do not initially track enemy and friendly minefield status in their area of operation and area of interest.**

Discussion*:* Platoons do not initially track enemy or friendly minefields or route status in their area of interest. This lack of tracking occurs throughout the platoon from the platoon leader to squad leaders and results in little to no situational awareness within the platoon. Because of these tracking problems, task force and supported units traveling on the routes do not know the status or condition of the route or if there are minefields along the route. This contributes to the continued problem of mine strikes within the brigade. The task force and units also need to track all mobility/survivability/countermobility issues within the supported unit's tactical operations center (TOC). Some of these issues are combat power status (personnel and equipment), attached engineer assets, Modular Pack Mine System (MOPMS) remote-control units, MOPMS batteries, and minefield clearance and route status. Platoons do not have the proper tracking tools and need a system of tracking charts that are easy to update. Platoons need to establish a system and then provide the means of ensuring that the entire platoon can keep it updated and disseminated. Platoons need to become familiar with the TOC SOP. The platoon leader needs to be proactive and play an integral part in developing the engineer portion of the TOC SOP.

Techniques and Procedures*:* The platoon should develop a standardized tracking mechanism to monitor the status of combat power, current enemy situation, obstacle locations, route status, and important supply issues. The actual use and understanding of the standardized tracking mechanisms/reports and the use of standard map boards for all vehicles would greatly facilitate information flow within the platoon and between the platoon and its higher headquarters. The platoon should develop an SOP for daily information updates that follows a set agenda covering these important command and control issues.

Captain Moses is a platoon engineer observer/controller at the Joint Readiness Training Center, Fort Polk, Louisiana. He commanded the HHC/20th Engineer Brigade and served as a platoon leader in the 618th Engineer Company (Light Equipment) and the 307th Engineer Battalion (Airborne), all at Fort Bragg, North Carolina.

("Engineer Exit Strategy" continued from page 53)

engineers and chiefs of engineer operations. Without this individual, the process would have taken much longer to implement and would have required constant revisions and different viewpoints among the participating soldiers. This constant presence is essential to the process and should be included with all peacekeeping forces. SFOR was fortunate to have a very experienced, hard-working local engineer on staff throughout the process.

Lessons Learned

A number of lessons were learned during the maturation process of the SFOR engineer operations. When a peacekeeping force initially moves into a war-torn country, the military engineer units are important to maintain freedom of movement. This is accomplished through the primary use of military engineer units. As the country moves toward self-sufficiency, an exit strategy must be developed to return road maintenance and repair back to the government agencies that are normally responsible for their upkeep.

Joint-venture projects can be developed with the government agencies to allow them more funds, yet keep the peacekeeping forces and NATO involved in the product—in this case, road repairs and maintenance. These joint-venture projects also allow local governments to develop standards that are more fair and equitable with their contractors. In time, the peacekeeping force can contribute less and less of the total amount of the cost as its presence decreases in the host country. Eventually, the cost of road maintenance and repair will be borne completely by the host nation, with minor contributions by the peacekeeping forces for the portion of the traffic on the national roadways. The final document should have provisions for change. As time passes, the road situation, as well as the peacekeeping force, will change. The MOU should allow for this.

Finally, it is important to have a person in the engineer operation who will ensure that the direction of engineer movement within the country remains consistent. This person can provide a bigger picture of the peacekeeping engineers and reinforce the need to return the country to its normal procedure for road repair and maintenance.

Colonel Ulekowski, United States Army Reserve, was the SFOR engineer chief of operations in Sarajevo, Bosnia, from August 1999 to May 2000. He is a graduate of the United States Military Academy and a registered professional engineer. His expertise is in construction management and engineering of construction projects. He was a vice president of a construction management firm in Houston, Texas, until he was activated for Operation Enduring Freedom. He is currently the Coalition Forces Land Component Command forward engineer at Camp Doha, Kuwait.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

Countermine/Counter-Booby Trap Center (CMCBTC). The 11 September attack raised the prospect of deploying ground troops to fight terrorism in Afghanistan. This focused attention on the capability of U.S. ground forces to operate in mined environments and created an urgent need to assess the countermine landscape. The TRADOC commander commissioned a combined-arms Countermine Task Force (CMTF) to evaluate doctrine, training, leader development, organization, materiel, and soldier (DTLOMS) solutions to address near-term countermine requirements for current forces and to develop a countermine operational concept to support the Objective Force. The CMTF met from October through December 2001 and developed materiel and science and technology recommendations. The TRADOC commander approved the recommendations.

The CMTF presented its findings and recommendations to the Army Review Oversight Council (AROC) on 19 December 2001. The AROC approved recommendations to acquire available countermine equipment and accelerate other systems. The AROC also approved funding to establish a CMCBTC to focus the Army's countermine efforts and to evaluate commercial off-the-shelf and nondevelopmental items of equipment. The U.S. Army Engineer School updated the AROC on 22 August 2002 on the status of systems recommended at the December AROC and made further recommendations based on lessons learned from Operation Enduring Freedom. The AROC approved establishing a mine-detection-dog unit, procuring area and route clearance sets, updating countermine doctrine, developing countermine functional courses, conducting countermine experiments and studies, and continuing the CMCBTC.

POC is Mr. Dorian D'Aria, (573) 596-0131, ext 35361; DSN –5361; or e-mail *dariad@wood.army.mil*.

Quality Assurance Element (QAE). The Army School System (TASS) has reorganized as the QAE under the assistant commandant of the U.S. Army Engineer School (USAES). The mission initially will remain the same in regard to TASS Battalions but will now include evaluation of training and assistance to the USAES. This reorganization is the result of the activation of the TRADOC Quality Assurance Program and the MANSCEN Quality Assurance Office.

POC is MAJ James Avants, 34114; DSN –4114; or e-mail *avantsj@wood.army.mil*.

Title XI Reorganization. Effective 1 October 2002, all engineer TASS Battalion Title XI soldiers will be aligned with the U.S. Army Engineer School Quality Assurance Element.

POC is MAJ James Avants, 34114; DSN –4114; or e-mail *avantsj@wood.army.mil*.

WANTED! Applicants for Terrain Analysis Technician Warrant Officer. MOS 81T NCOs with 5 to 12 years of service may apply. The duty description is in Department of the Army Pamphlet 611-21, *Military Occupational Classification and Structure*. Soldiers who wish to become warrant officers may obtain information on the home page of the Warrant Officer Career Center at *http://leav-www.army.mil/wocc/* or the U.S. Army Recruiting Command at *http://www.usarec.army.mil/hq/warrant/*.

POC is SGM Michael Cline, 34087; DSN –4087; or e-mail *clinemi@wood.army.mil*.

Proponent Guidance "Promotion Book." The Engineer Personnel Proponency Office (EPPO) prepares proponent guidance for panel members to use to select soldiers for promotion to senior grades (E-7 through E-9). The guidance is posted on the EPPO Web site for NCOs to check where they stand. New guidance is posted on the day the annual board meets. Guidance for the upcoming command sergeant major/sergeant major board is currently being worked.

POC is SGM Michael Cline, 34087; DSN –4087; or e-mail *clinemi@wood.army.mil*.

Captain (CPT) Officer Education System (OES). The original proposed CPT OES concept remains unchanged pending any guidance that may emerge from the briefings to the Chief of Staff and Vice Chief of Staff of the Army.

The Combined Arms Staff Course (CASC) consists of five weeks of training (three weeks advanced distributed learning [ADL] and two weeks of resident instruction). All officers, regardless of branch, must complete the CASC common core module consisting of two weeks of ADL. Officers selected for primary staff positions (such as S1, S2, assistant S3/S3 air, S4, S5, or battalion maintenance officer) will, upon completion of the CASC Common Core, complete a third week of ADL before assuming the staff position. Officers being assigned to a special staff position (such as fire support officer, assistant brigade engineer, or petroleum officer) will, upon completion of the CASC Common Core ADL module, complete a third week of ADL tailored to that staff position, followed by two weeks of resident technical training at their respective branch school/center.

The Combined Arms Battle Command Course (CABCC) consists of ten weeks of training (four weeks of ADL and six weeks of resident instruction). Officers selected for company command must compete CABCC before assuming command. Each phase of CABCC must be completed sequentially before starting the next phase of training. CABCC consists of four weeks of ADL instruction with two distinct focuses. The first two weeks of ADL, referred to as CABCC Common Core, will be developed by the Combined Arms Command according to TRADOC and will contain all non-branch-specific topics. The second two weeks of ADL, referred to as the Preresident Company Commander's Course, will be developed by individual branch schools/centers and will focus on specific branch skills and knowledge. Upon completion of all ADL, officers will attend the resident training referred to as the Company Commander's Course, which focuses on company command. Upon completion of the Company Commander's Course, all officers will complete a Train-the-Trainer Course, consisting of two weeks of resident training at one of the Combat Training Centers.

POC is MAJ Dale Scherer, Transformation Cell team chief (573) 596-0131, ext. 35747; e-mail *subscribed schererd@wood.army.mil*; or LTC Jeff Bedey, Director, Department of Instruction (573) 596-0131, ext. 35647; or e-mail *bedeyj@wood.army.mil*.

Center for Engineer Lessons Learned (CELL). The Web site repository of lessons learned is continually being updated. We have now added a listing and short synopsis of Operation Enduring Freedom lessons learned. You can obtain this material by viewing the CELL Web site, selecting the items you want, and sending an e-mail request or calling the CELL POC. Most of the current operations material is FOUO and cannot be placed on a public Web site but can be sent to a *.mil* e-mail address.

We thank the units and individuals that have sent digital copies of lessons learned and after-action review (AAR) products. We request that all units forward engineer lessons learned and AARs from exercises and operations to the CELL POC. This material is used to revise/develop doctrine and training and is provided to units preparing to conduct similar missions. Others can benefit from your experiences.

POC is MAJ Jan Kirkton, 38112; DSN -8112; or e-mail *kirktonj@wood.army.mil*. The CELL Web site address is *http://www.wood.army.mil/CELL/index.htm*.

Directorate of Training Development (DOTD)

Field Manual Update. The following field manuals have recently been sent to the Army Training Support Center for print and distribution. Look for them in the near future on the Reimer Digital Library at *http://155.217.58.58/atdls.htm*. The revisions in all three manuals incorporate the "expert" operator procedures for conducting mine detection operations with the AN/PSS-12 mine detector.

- Change 3 to FM 3-34.2, *Combined-Arms Breaching Operations*
- Change 3 to FM 20-32, *Mine/Countermine Operations*
- Change 2 to FM 5-34, *Engineer Field Data*

POC is Tina Waters, (573) 596-0131, ext. 35288; DSN -5288; or e-mail *waterst@wood.army.mil.*

Visual Archive. The History Office at the Engineer School is developing a visual archive. It currently has more than 18,000 photographs, largely from World War II and Korea. Units that would like to contribute photographs (copies) or other visual material should contact Dr. Larry D. Roberts, Historian, U.S. Army Engineer School, Fort Leonard Wood, Missouri 65473. Where possible, caption information should accompany the images. If you have questions, please call Dr. Roberts at (573) 563-6109.

News and Notes

Contract Awarded for Production of DTSS-L. The Engineer Research and Development Center's (ERDC's) Topographic Engineering Center, Alexandria, Virginia, recently awarded a production contract totaling more than $5 million to SECHAN Electronics Inc., Lititz, Pennsylvania., to build 16 Digital Topographic Support System-Light (DTSS-L) units in FY02, with an option for 15 additional units in FY03.

The DTSS provides digital maps and updates to battlefield commanders and weapons platforms in support of mission planning, rehearsal, and execution. The DTSS automates terrain analysis and visualization, database development and management, and graphics reproduction. The system uses the latest commercial off-the-shelf technology in printers, scanners, and computer workstations, combined with image processing and geographic information system software.

The DTSS-L version is shelter-mounted on high-mobility, multipurpose, wheeled vehicles (HMMWVs) and is capable of providing digital, computer-generated terrain analysis data and products to combat commanders located at brigade through echelon-above-corps levels. They are transportable by air, sea, rail, and land and are capable of worldwide deployment.

This is the second production contract for DTSS-Ls; SECHAN previously built 52 DTSS-Ls (FY99-01). ERDC's Combat Terrain Information Systems Project Management Office has a requirement to procure and field 83 DTSS-Ls. The new contract with SECHAN will complete this requirement in FY03. The DTSS-Ls procured in FY02, as a result of this latest contract award, will be fielded to various U.S. Army engineer terrain teams.

POC is Mark Hainsey, Project Manager, (703) 428-6734.

The Engineer Writer's Guide

Engineer is a professional-development bulletin designed to provide a forum for exchanging information and ideas within the Army engineer community. We include articles by and about officers, enlisted soldiers, warrant officers, Department of the Army civilian employees, and others. Writers may discuss training, current operations and exercises, doctrine, equipment, history, personal viewpoints, or other areas of general interest to engineers. Articles may share good ideas and lessons learned or explore better ways of doing things.

Articles should be concise, straightforward, and in the active voice. If they contain attributable information or quotations not referenced in the text, provide appropriate notes at the end of the article, not at the bottom of each page. Spell out each acronym the first time you use it; don't assume that everyone knows what it means. Text length should not exceed 2,000 words (about eight double-spaced pages). Shorter after-action-type articles, reviews of books on engineer topics, and letters to the editor are also welcome.

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Photo 1, top left: Bridging the Marne River. Trestle and crib bridge being constructed by Companies A and C, 6th Engineers. 24 July 19
Photo 2, top right: Loading operations in the coral pits on the Los Negros Islands in the South Pacific. Heavy-duty bulldozers loosen
coral sand and 2-cubic-yard shovels load the loose sand into the heavy-duty 2 1/2-ton G.I. trucks and 3/4-ton weapon carriers. **Phot**
bottom right: 815th Engineer Battalion (Construction), ATT, 15-19 May 1961. Spreading aggregate on asphalt road construction, F
Bliss, Texas. **Photo 4, bottom left:** Engineers putting in stringers after posts and sidewalls have been placed. Stringers will be covered
two layers of planking. Italy, 1944.
(Photos courtesy of the U.S. Army Engineer School History Office.)

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